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Diagnostic and Evolutionary Aspects of Nephrotic Syndrome in a Pediatric Setting at the Zinder National Hospital

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Abstract

Introduction: The nephrotic syndrome (NS) is the most common glomerular nephropathy in children. The aim of this work was to study the diagnostic and evolutionary aspects of NS in pediatrics at the national Hospital of Zinder (Niger). **Materials and methods**: This descriptive cross-sectional study was carried out over an 11-month period from January 1, 2023 to November 30, 2023. Included were all children aged 5 to 15 years admitted during the study period for nephrotic syndrome in the Pediatric Department B of the National Hospital of Zinder (HNZ). **Results**: A total of 26 patients had fulfilled the inclusion criteria, i.e., a hospital frequency of 0.69%. The male sex was predominant with a frequency of 57.69% (sex ratio = 1.3). The 5 to 10 years age group was the most represented with a frequency of 57.69%. The mean age at diagnosis was 8 ± 2.9 years. A delay in consultation was observed in the majority of patients. The consultation time was longer than 14 days for 16 patients, i.e., 61.54%. Edema was found in all patients at the time of consultation, i.e., in 100% of the cases. The 24-hour proteinuria was between 50 to 100 mg/kg/day in 65% of cases with an average of 82.78 mg/kg/d. The protidemia and the average albuminemia were respectively 44.85 g/L and 18.78 g/L. The SN was pure in 15 patients (57.69% of cases) and impure in 11 patients (42.31% of cases). The treatment was essentially based on oral corticosteroid therapy (prednisolone: cotipred 20 mg). Corticosensitivity was observed in 22 patients, i.e., 84.61%, one (1) case of corticodependence (3.85%) and two (2) cases of corticoresistance, i.e., 7.69%. One (1) case of death was recorded, i.e., a frequency of 3.85%. Only one (1) patient had benefited from a renal biopsy puncture

(RBP) and an anatomopathological examination. **Conclusion**: SN remains common in children at the HNZ. The improvement of the technical platform for PBR and anatomopathological examinations as well as the establishment of social security prove necessary for a better management of SN in children at the HNZ.

Keywords

Nephrotic Syndrome, Child, Corticosteroids, Zinder National Hospital

1. Introduction

Nephrotic syndrome (NS) is a frequent glomerulopathy in pediatrics, characterized by a leakage of blood proteins to the urine through damaged glomeruli [1]. The nephrotic syndrome of the child is defined biologically by the association of a 24-hour proteinuria greater than 50 mg/kg, a hypo-protidemia less than 60 g/L and a hypo-albuminemia less than 30 g/L. It is said to be impure when it is accompanied by arterial hypertension (HYPERTENSION) and/or renal insufficiency and/or microscopic hematuria (Hu) and/or if proteinuria is not selective. Otherwise, the SN is said to be pure [2]-[6]. It has an estimated hospital frequency of 0.26% in Côte d'Ivoire, 0.27% in Senegal and 0.8% in Congo Brazzaville [3] [7] [8].

The nephrotic syndrome is one of the most frequent glomerular nephropathies in children aged 2 to 12 years, often after an infectious or allergic trigger [4] [9]-[11]. The annual global incidence has been estimated at between 1 and 4.7 cases/100,000 children [1] [9] [12]-[14]. Data on nephrotic syndrome are limited in sub-Saharan Africa.sub-Saharan Africa. It is predominant among male patients with a sex ratio of 1.7 to 2 [2] [7] [9]-[11] [15].

Nephrotic syndrome is often associated with multiple relapses, with a psychological and academic impact and presents challenges in terms of diagnosis and management [16]. Its pathophysiology remains imperfectly known. Recent studies have identified genetic mutations responsible for hereditary forms of SN often progressing to renal insufficiency and progress is being made in understanding the pathophysiology and mechanisms of glomerular permeability to plasma proteins [15] [16]. The response to treatment varies according to the histological classification with steroid sensitivity observed in more than 90% of children with minimal lesion disease (MCD) compared to 25 to 50% of those with focal segmental glomerulosclerosis (FSGS) [1] [17]-[19]. Indications for renal biopsy are limited to unusual presentations or cases of non-response to corticosteroid therapy. The nephrotic syndrome of the child therefore presents itself in 3 clinical forms according to the response to the initial corticosteroid therapy: the corticosensitive nephrotic syndrome (CNS), the corticodependent nephrotic syndrome (SNCD) and the corticoresistant nephrotic syndrome (CRNS) [9] [19] [20]. There are also primary or idiopathic nephrotic syndrome (without initial cause), secondary nephrotic syndrome following an extra-renal cause and congenital nephrotic syndrome [12] [14] [21].

The nephrophrotic syndrome can be defined as "impure" when it is accompanied by arterial hypertension and/or renal insufficiency and/or microscopic hematuria and/or if proteinuria is not selective. Otherwise, it is defined as "pure" [2]-[6]. Impure NS is less likely to be primary and respond less easily to corticosteroid therapy. Complications of NS and its treatment can put the vital prognosis of some children at risk. The aim of this study was to study the diagnosis and evolution of SN in the context of limited resources in a pediatric setting at the National Hospital of Zinder.

2. Patients and Methods

2.1. Type, Period and Framework of the Study

This was a cross-sectional descriptive study with prospective data collection carried out in the pediatrics department B of the National Hospital of Zinder from January 1, 2023 to November 31, 2023, i.e., for a period of eleven (11) months.

2.2. Study Population

All patients aged 5 to 15 years who were admitted to the pediatric department B of the HNZ with NS during the study period were eligible for the study. Children whose parents had not given their consent and children under the age of 5 or over the age of 15 were excluded. The NS in children is defined by the association of 24-hour proteinuria greater than 50 mg/kg/24h, a serum protein < 60 g/L and hypoalbuminemia < 30 g/L.

For each child, we studied the socio-demographic characteristics (age, sex, origin); clinical (history, general condition, reasons for admission and time of consultation); paraclinical (24-hour proteinuria, albuminemia, and protidemia, renal function, blood count, antistreptolysin O). Likewise, the data; therapeutic and evolutionary were explored.

All examinations and medications are the responsibility of the parents. The government system of free care only covers children under 5 years of age.

2.3. Ethical Considerations

The study was approved by the Faculty of Health Sciences of the André Salifou University of Zinder and the management of the National Hospital of Zinder. The informed consent of the parents or people in charge of the patients was obtained. Anonymity and medical confidentiality were respected.

2.4. Data Analysis

The data were collected on a pre-established form based on information obtained from the consultation register, the hospital file and an interview with the child parent or custodian. The data were entered on the Excel 2010 software and analyzed using the Epi info software version 7.2.2.2. A number was used to identify each patient, guaranteeing the confidentiality of the patients' identity. The link age between the variables was estimated using Pearson's Chi square test. The

difference was significant if the p-value was less than 0.05. The risk was quantified by estimating the Odds Ratio (OR) and the confidence interval (CI) set at 95 %.

3. Results

This work reports the characteristics of nephrotic syndrome in a hospital setting. The limitations of this study were above all the lack of financial means by the parents for carrying out etiological examinations, including the PBR, even if indicated.

During the study period, out of a total of 3758 patients, 26 cases of nephrotic syndrome in children were recorded, representing a hospital prevalence of 0.69%.

Table 1 presents the socio-demographic characteristics of the patients. The age group of 5 to 10 years was the most represented with 57.69% (n = 15) and the average age was 8 ± 2.99 years with extremes of 5 and 14 years. A male predominance was observed, with a sex ratio of 1.3. Children from rural areas accounted for 76.92% (n = 20) of the cases.

Table 1. Socio-demographic characteristics of children.

Variables		Frequency (n)	Percentage (%)
Age group	5 - 10	15	57.69
	10 - 15	11	42.31
	Total	26	100.00
Gender	Male	15	57.69
	Female	11	42.31
	Total	26	100.00
Origin	Rural	20	76.92
	Urban	6	23.08
	Total	26	100.00

The history of angina and edema were found in 11.54% and 7.7%, respectively. The consultation period was greater than or equal to 14 days in 61.54% (n = 16) of the cases and statistically significant with the reason for consultation (OR = 10; CI [0.87 - 114.75]; p = 0.04). Anasarca was the main reason for consultation in 84.62% (n = 22) of cases and was the main sign found on physical examination followed by mucocutaneous pallor in 84.62% and 53.84% respectively. HYPERTENSION was found in 23.07% (n = 6) of the cases (Table 2).

Hyperleukocytosis was present in 30.23% (n = 8) of patients and anemia in 84.62% (n = 22) of cases. Nine (9) children had high azotemia, i.e., 34.60%, and serum creatinine was high in three patients, i.e., 11.54%. The 24-hour proteinuria was greater than 50 mg/kg/day in all patients. It was between 50 and 100 mg/kg/day in 65% of cases with an average of 82.78 mg/kg/d (extremes ranging from 54 to 244 mg/kg/d). There was no significant correlation between the 24-hour proteinuria and

the consultation time (OR = 1.46; p = 0.69). The average protidemia was 44.85 g/L with extremes of 3.85 and 58.70 g/L. The average albuminemia was 18.78 g/l with extremes ranging from 7.7 to 29 g/l. Antistreptolysins O (ASLO) were positive (greater than 200 units/ml) in 61.54% (n = 16) of patients. The nephrotic syndrome was pure in 57.69% (n = 15) and impure in 43.31% of cases (n = 11) (Table 3).

The patients received diuretics in 92.30% (n = 24) of cases, and antihypertensive drugs were used in 19.230% (n = 5) of cases. Apart from oral corticosteroid therapy which was the basic treatment, two (2) patients received a bolus of methyl prednisone, i.e., a frequency of 7.70%. In 84.61% (n = 22) of cases the patients were corticosensitive and 3.85% (n = 1) were corticosensitive. There is one (1) case of death, i.e., 3.85% (Table 4). Out of two patients who developed corticoresistance, one (1) had received a renal biopsy puncture (PBR) which had objectified segmental and focal hyalinosis.

Table 2. Reason and consultation period, clinical signs.

Variables		Frequency (n)	Percentage (%)
Mode of admission	Direct	15	57.69
	Referred	11	42.31
	Total	26	100.00
Reason for consultation	Generalized edema	22	84.61
	Edema of the lower extremities alone	3	11.54
	Morning puffy facial alone	1	3.85
	Total	26	100.00
Consultation period (days)	<7	3	11.54
	7 - 14	7	26.92
	≥14	16	61.54
	Total	26	100.00
Personal background	Angina	3	11.54
	Hematuria	1	3.85
	Edema	2	7.70
Clinical signs	Generalized edema	22	84.62
	Pallor	14	53.84
	HTA	6	23.07
	Convulsions	4	15.38
	Fever	3	11.54

Table 3. Results of biological analyzes of the patients.

Variables			Frequency (n)	Percentage (%)
Proteinuria of 24 h (mg/kg/d)	50 - 100		17	65.38
	100 - 150		5	19.23
	150 - 200		3	11.54
	>200		1	3.85
	Total		26	100.00
Protidemia (g/L)	<30		4	15.40
	30 - 40		6	23.07
	40 - 60		16	61.53
	Total		26	100.00
Albuminemia (g/L)	<10		3	11.54
	10 - 21		13	50.00
	21 - 30		10	38.46
	Total		26	100.00
Renal function	Urea (Mmol/L)	Normal	17	65.40
		Raised	09	34.60
	Blood creatinine (µmol/L)	Normal	23	88.46
		Raised	03	11.54
CBC results	White blood cell rate	Normal	18	69.77
		High	08	30.23
	Hemoglobin level	Normal	4	15.38
		High	22	84.62
	Platelet rate	Normal	21	80.77
		High	05	19.23
	ASLO positive (>200 units/ml)		16	61.54
Other additional examinations	CRP positive (>6 mg/L)		2	7.70

ASLO: antistreptolysine O; CRP: C-reactive protein.

Table 4. Therapeutic characteristics and evolution of patients.

Variables		Frequency (n)	Percentage (%)
Treatment	Corticosteroid therapy	26	100
	Diuretics	24	92.30
	Antibiotic therapy	26	100
	IEC	3	11.53
	Calcium channel blocker	2	7.70
Evolution	Corticosensitive	22	84.61
	Corticosteroid-dependent	1	3.85
	Corticosteroid-resistant	2	7.69
	Death	1	3.85
	Total	26	100.00

4. Discussion

Over an 11-month period, 3758 children were admitted to pediatrics, including 26 with NS, i.e., a hospital frequency of 0.69%. This prevalence is lower than that reported by Keita *et al*. in Senegal in 2017 in a study carried out among children aged 2 to 12 years [22] with 1.56%. Our rate is close to that reported in a study by Moyen *et al*. on nephrotic syndrome in children aged 3 to 17 years at the University Hospital of Congo Brazzaville with 0.80% [7]. The difference in recruitment mode as well as the study area could explain this variation in frequency. Indeed, our study was done in a department that only cares for children from 5 to 15 years old. A larger study concerning children aged 0 to 15 years would make it possible to have a prevalence of nephrotic syndrome in the pediatric population.

The average age of our patients was 8 ± 2.99 years and the age range of 5 to 10 years was the most common with 57.69%. According to the literature, SN in children usually occurs between the ages of 2 and 12 [9] [19] [23]. Gbadoé AD *et al*. reported a mean age between 6 and 8 years in Black Africa [5]. Serre J. *et al*. had found an average age of 4.6 years in India [13] and Loire, Deschenes G reported an average age of 4 years in France in 2015 [24]. Our result is in harmony with H Savadogo's in Ouagadougou in 2019 [25] who had found an average age of 7 years 5 months and lower than the result reached by Moyen *et al*. in Congo Brazaville who reported an average age of 10 years 8 months [7]. This result could be explained by the fact that the majority of our patients were 5 to 10 years old and that the nephrotic syndrome most often occurs in children aged 2 to 12 years [9]. In most of the literature data the nephrotic syndrome was predominant in the male sex [26] [27]. In our study, the sex ratio was 1.3 in favor of boys. Okoro BA *et al*.

in Nigeria in 2000 [28] and H Savadogo [25] had found a sex ratio of 1.28 and 1.3 respectively. However, this male predominance has not always been found. When nearing adolescence, there is a tendency towards a cancellation of the male predominance [1]. The fragility of the male sex due to the XY chromosome could explain the male predominance although there is no statistically significant link between sex and SN [29].

In our series, 76.92% of the patients came from rural areas. This result could be explained by the unbalanced diet and exposure to many triggering factors such as infections that could have been missed or poorly managed in rural areas. The majority of children presented late, with 61.54% more than 2 weeks after the onset of symptoms, 26.92% between 7 and 14 days and 11.54% within a week. This delay in consultation could be explained in our context where self-medication and the use of traditional products constitute the first line of care sought by the population, for cultural but also economic reasons. Rural children may also report later than urban children since more resources are needed to reach the hospital, which families do not always have immediately. Edema represented the reason for consultation present in all our patients. It was sometimes associated with abdominal pain and dyspnea in rare cases. The edema was generalized (edema of the lower extremities, ascites, morning swelling of the face and hydrocele in boys) in 84.62% of cases. This is similar to the results of Savadogo *et al.* [26] where edema was observed in 86% of cases at presentation. This may reflect an aggravation of the disease given the delay in the consultation.

Hypertension is a criterion for SN impurity. The risk of HYPERTENSION with SN is higher in black subjects [29]. In our series, high blood pressure was found in 23.07%. This prevalence is similar to that reported by Oukrif *et al.* in Algeria in 2017 [30] with a prevalence of 21%. A study by Ndogon *et al.* in Senegal in 2017 [3] reported a lower percentage of 15%. A correlation between the risk of arterial hypertension and the age of occurrence greater than 8 years in children with NS was observed in a Chinese study [31]. The older age of the children in our study may be consistent with this. It is also important to note that hypertension and the "impurity" of SN suggest a secondary form of SN or even a nephritic/nephrotic syndrome, which has a pathophysiology and a course of the disease different from those of primary SN. The differences in the composition of the cases between the studies can therefore have an impact on these associations.

At the physical examination, 14 patients presented a pallor (53.84%). This anemia could be explained by the low socioeconomic level of our patients, mostly from rural areas, because this segment of the population was the most affected by nutritional deficiencies including iron deficiency. Fever was found in 11.54% of cases (n = 3). The increase in the excretion of transferrin in the urine in SN could contribute to a decrease in hemoglobin. In our series, 22 patients had anemia, i.e., a frequency of 84.62% with an average value of 9.4 g/dl. Anemia was also common in the study by H Savadogo *et al.* [25], occurring in 95.3% of patients with an average Bh of 10.3 ± 2.6 g/dl. This result could also be explained in our context by

the insufficiency of a balanced diet and pre-existing anemia, as well as chronic helminth infections.

By definition, 100% of our patients had low serum protein and albumin levels with respective averages of 41.19 ± 12.41 g/L and 18.46 ± 5.97 g/L. Similar values were reported by H Savadogo *et al.* [25], Keita *et al.* in 2017 [23] and Ndongo A *et al.* in Senegal in 2016 [3]. This result could be explained in our context by the Pu of the 24 hours which was less than 100 mg/kg/24H in 65% of cases. The massive proteinuria of the 24 hours at the level of the SN had been reported by several authors in the literature [6] [29]. In our series, the 24-hour proteinuria was between 50 and 100 mg/ kg/d in 65% of cases with an average value of 82.78 mg/kg/d. Sfaihi *et al.* in 2010 [15] and A Ndongo *et al.* in 2016 in Senegal [2] had reported mean values higher than ours respectively with 100 mg/kg/d and 113.70mg/ kg/d. Our result was significantly lower than the values found in the literature, this result could be explained by the consultation period which was in the majority of cases between 2 to 4 weeks.

In our series, the SN was pure in 57.69% (n = 15) and impure in 42.31% of cases (n = 11). According to literature data, pure SN was predominant in the majority of cases. NS associated with hypertension and/or hematuria and/or renal dysfunction is defined as impure NS [4] [17] [32] [33]. H Savadogo *et al.* [26] had reported a rate of 43.2% of pure SN and 56.8% of impure SN in their cohort. This result could be explained by the high frequency of ASLO positivity in our study and the higher risk of most kidney diseases in people of African origin.

Primary nephrotic syndrome is a glomerular nephropathy that requires long-term oral corticosteroid therapy [31]. This treatment regimen has been reported by several authors throughout the literature [31] [34]. Nephrotic syndrome responds quickly to corticosteroid therapy with the disappearance of proteinuria at 1 month in 90% of cases [35]. In our study we found a sensitivity to corticosteroid therapy in 84.61% of cases with one case of corticosteroid dependence, i.e., 3.85% and two patients developed resistance corticosteroid therapy, i.e., in 7.69% of cases. Keita *et al.* in 2017 [23] and Ndongo *et al.* in 2016 [3], all in Senegal respectively reported corticosensitivity in 77% and 78% of cases and corticoresistance in 13% and 22% of cases. On the other hand, H Savadogo *et al.* in Ouagadougou [26] reported 56.7% corticoresistance, 40% corticosensitivity and 3.3% corticodependence.

5. Conclusion

We observed that the nephrotic syndrome in children at the National Hospital of Zinder (HNZ) represented 0.69% of children admitted to pediatrics during the study period. The age group of 5 to 10 years was the most found. The male sex was the most represented. In this series, the edemato-ascitic syndrome was the main clinical sign. The improvement of the technical platform to carry out the RBP in case of indication and the carrying out of the anatomopathological examinations as well as the establishment of social security, will undoubtedly make it possible to improve the care of the child's nephrotic syndrome at the HNZ.

6. The Difficulties

The insufficiency of the technical platform was ended by the non-realization of the Renal Biopsy Puncture (RBP) in case of indication (cortico-resistance, corti codependency).

The lack of financial resources hindered the realization of certain examinations necessary for the etiological diagnosis (search for sickle cell anemia, hepatitis B, syphilis, lupus...).

Contributions of the Authors

All the authors have contributed to the realization of this work.

Conflicts of Interest

The authors declare that they have no conflict of interest.

References

[1] Ernould, S., Godron, A., Nelson, J., Rigothier, C., Llanas, B. and Harambat, J. (2011) Syndrome néphrotique idiopathique de l'enfant: Incidence, présentation clinique et devenir dans le département de la Gironde, France. *Archives de Pédiatrie*, **18**, 522-528. https://doi.org/10.1016/j.arcped.2011.02.012

[2] Ndongo, A., Thionganane, A., Kéïta, Y., Boiro, D., Basse, I., Seck, N., *et al.* (2016) Nianang A6, Moreira C3, Diouf B6, Ndiayaye O4. Les particularités du syndrome néphrotique de l'enfant au Sénégal. *Cames Sante*, **4**, 1-4.

[3] Ndongo, A.A., Sylla, A., Fall, A.L. and Kéïta, Y. (2016) Le syndrome néphrotique de l'enfant au centre hospitalier universitaire de Dakar. *Archives de Pédiatrie*, **23**, 653-654. https://doi.org/10.1016/j.arcped.2016.03.008

[4] Bérard, É., Broyer, M., Dehennault, M., Dumas, R., Eckart, P., Fischbach, M., *et al.* (2005) Syndrome néphrotique pur (ou néphrose) corticosensible de l'enfant. *Néphrologie & Thérapeutique*, **1**, 150-156. https://doi.org/10.1016/j.nephro.2005.06.003

[5] Gbadoé, A.D., Atakouma, D.Y., Napo-Koura, G., Gouna, A., Akakpo-Maxwell, O., Dogba, M.A., *et al.* (1999) Le syndrome néphrotique primitif de l'enfant en Afrique noire. *Archives de Pédiatrie*, **6**, 985-989. https://doi.org/10.1016/s0929-693x(99)80594-6

[6] Cochat, P., Cazet, F., Liutkus, A., Mourani, C., Exantus, J. and Akatcherian, C. (2005) Néphrologie pédiatrique dans les pays en développement. *Archives de Pédiatrie*, **12**, 723-725. https://doi.org/10.1016/j.arcped.2005.04.061

[7] Moyen, G., Assambo-Nkieli, C., Fourcade, V., *et al.* (1993) Syndrome néphrotique de l'enfant au chu de Brazzaville a propos de 36 cas. *Médecine d' Afrique Noire*, **40**, 383-388.

[8] Diarrassouba, G., Adonis-Koffy, L., Gorgui, Kouassi, F., Koutou, E.J. and Niamien, E. (2010) CL116—Le Levamizole dans le traitement du syndrome néphrotique de l'enfant en Côte d'Ivoire. *Archives de Pédiatrie*, **17**, 32. https://doi.org/10.1016/s0929-693x(10)70332-8

[9] Boyer, O., Baudouin, V., Bérard, E., Dossier, C., Audard, V., Guigonis, V., *et al.* (2017) Aspects cliniques du syndrome néphrotique idiopathique de l'enfant. *Archives de Pédiatrie*, **24**, 1338-1343. https://doi.org/10.1016/j.arcped.2017.09.022

[10] Habib, R. and Gubler, M.C. (1971) Les lésions glomérulaires focales des syndromes

néphrotiques idiopathiques de l'enfant: A propos de 49 observations. *Nephron*, **8**, 382-401. https://doi.org/10.1159/000179941

[11] Pinçon, A. and Nobili, F. (2008) SFP-P083—Néphrologie—Etude épidémiologique du syndrome néphrotique idiopathique de l'enfant de moins de 18 ans en Franche-Comté en 2007. *Archives de Pédiatrie*, **15**, 964-969. https://doi.org/10.1016/s0929-693x(08)72216-4

[12] Downie, M.L., Gallibois, C., Parekh, R.S. and Noone, D.G. (2017) Nephrotic Syndrome in Infants and Children: Pathophysiology and Management. *Paediatrics and International Child Health*, **37**, 248-258. https://doi.org/10.1080/20469047.2017.1374003

[13] Serre, J., Prat, L., Merieau, E., Cloarec, S., Benoit, S. and Halimi, J. (2016) Epidémiologie du syndrome néphrotique idiopathique de l'enfant en Indre et Loire: Étude rétrospective sur 30 ans. *Archives de Pédiatrie*, **23**, 637-641. https://doi.org/10.1016/j.arcped.2016.03.042

[14] Hampson, K.J., Gay, M.L. and Band, M.E. (2021) Pediatric Nephrotic Syndrome: Pharmacologic and Nutrition Management. *Nutrition in Clinical Practice*, **36**, 331-343. https://doi.org/10.1002/ncp.10622

[15] Sfaihi, L., Damak, F., Gargouri, L., Majdoub, I., Kamoun, T. and Hachicha, M. (2010) P296—Aspects évolutifs et thérapeutiques du syndrome néphrotique de l'enfant. *Archives de Pédiatrie*, **17**, 119-124. https://doi.org/10.1016/s0929-693x(10)70694-1

[16] Maisonneuve, N., Binaut, R. and Vanhille, P. (2004) Syndrome néphrotique. *EMC—Médecine*, **1**, 102-109. https://doi.org/10.1016/j.emcmed.2003.12.004

[17] Ishikura, K., Matsumoto, S., Sako, M., Tsuruga, K., Nakanishi, K., Kamei, K., *et al*. (2015) Clinical Practice Guideline for Pediatric Idiopathic Nephrotic Syndrome 2013: Medical Therapy. *Clinical and Experimental Nephrology*, **19**, 6-33. https://doi.org/10.1007/s10157-014-1030-x

[18] Pasini, A., Aceto, G., Ammenti, A., Ardissino, G., Azzolina, V., Bettinelli, A., *et al*. (2014) Best Practice Guidelines for Idiopathic Nephrotic Syndrome: Recommendations versus Reality. *Pediatric Nephrology*, **30**, 91-101. https://doi.org/10.1007/s00467-014-2903-7

[19] Ranawaka, R., Dayasiri, K., Gamage, M. and Wickramasinghe, P. (2018) A Brief Overview of the Management of Steroid-Sensitive Nephrotic Syndrome in Children. *Journal of the Postgraduate Institute of Medicine*, **5**, e71. https://doi.org/10.4038/jpgim.8184

[20] Bagga, A. and Mantan, M. (2005) Nephrotic Syndrome in Children. *Indian Journal of Medical Research*, **122**, 13-28.

[21] Niaudet, P. (2004) Syndromes néphrotiques congénitaux et infantiles. *EMC—Pédiatrie*, **1**, 89-96. https://doi.org/10.1016/j.emcped.2003.09.003

[22] Keita, Y., Lemrabott, A.T., Sylla, A., Niang, B., Fary, E.H., Dial, C.M., *et al*. (2017) Le syndrome néphrotique idiopathique (SNI) de l'enfant à Dakar: À propos de 40 cas. *Pan African Medical Journal*, **26**, Article No. 161. https://doi.org/10.11604/pamj.2017.26.161.10130

[23] Centre de Référence Syndrome Néphrotique Idiopathique. Protocole National de Diagnostic et de Soins (PNDS) Syndrome néphrotique idiopathique de l'enfant. http://www.google.com

[24] Deschênes, G., Vivarelli, M. and Peruzzi, L. (2017) Variability of Diagnostic Criteria and Treatment of Idiopathic Nephrotic Syndrome across European Countries. *European Journal of Pediatrics*, **176**, 647-654. https://doi.org/10.1007/s00431-017-2891-2

[25] Savadogo, H., Coulibaly, G., Koueta, F., Ouédraogo/Yugbare, S.O., Kaboré, A., Dao, I., *et al*. (2019) Réponse à la corticothérapie du syndrome néphrotique de l'enfant à Ouagadougou (Burkina Faso). *Revue Africaine et Malgache de Recherche Scientifiques*, **1**, 160-169.

[26] Deschênes, G. and Leclerc, A. (2010) Épidémiologie du syndrome néphrotique de l'enfant. *Archives de Pédiatrie*, **17**, 622-623. https://doi.org/10.1016/s0929-693x(10)70028-2

[27] Antoine, B., Gregoire, B. and Brigitte, C. (2020) Pédiatrie pour le praticien. 7th Edition, Elsevier Masson, 824.

[28] Okoro, B.A., Okafor, H.U. and Nnoli, L.U. (2000) Childhood Nephrotic Syndrome in Enugu, Nigeria. *West African Journal of Medicine*, **19**, 137-141.

[29] Eddy, A.A. and Symons, J.M. (2003) Nephrotic Syndrome in Childhood. *The Lancet*, **362**, 629-639. https://doi.org/10.1016/s0140-6736(03)14184-0

[30] Oukrif, L., Toudji, L., Bekkat, D., Zemiri, F., Boukhil, K.S., Messadi, W., *et al*. (2017) Syndrome néphrotique idiopathique chez 408 enfants. *Néphrologie & Thérapeutique*, **13**, 369-370. https://doi.org/10.1016/j.nephro.2017.08.241

[31] Chemli, J., Boussetta, S., Hassayoun, S., Bouhlel, R., Zouari, N., Krid, S., *et al*. (2008) SFP-P210—Néphrologie—Syndrome néphrotique idiopathique corticorésistant de l'enfant: Étude de 20 cas. *Archives de Pédiatrie*, **15**, 1005. https://doi.org/10.1016/s0929-693x(08)72338-8

[32] Baudin, B. (2013) Syndrome néphrotique. *Revue Francophone des Laboratoires*, **2013**, 51-56. https://doi.org/10.1016/s1773-035x(13)72179-8

[33] Netter, F.H. (1999) Atlas d'anatomie humaine. 2nd Edition, Maloine, 311-324.

[34] Ben Abdallah Chabchoub, R., Turki, H., Gargouri, L., Majdoub, I., Ben Halima, N. and Mahfoudh, A. (2010) P292—Syndrome nephrotique corticodépendant. *Archives de Pédiatrie*, **17**, Article No. 123. https://doi.org/10.1016/s0929-693x(10)70690-4

[35] Maalej, B., *et al*. (2019) Prise en charge thérapeutique du syndrome néphrotique cortico-dépendant de l'enfant. *Journal d'Information Médicale de Sfax*, **1**, 1-11.