CLINICAL PROFILE OF CHILDREN WITH STEROID-SENSITIVE IDIOPATHIC NEPHROTIC SYNDROME RELAPSING IN THE FIRST YEAR AT DR. SOETOMO HOSPITAL, SURABAYA

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ABSTRAK

Sindrom Nefrotik (NS) ditandai dengan proteinuria masif, hipoalbuminemia, disertai dengan edema, dan hiperkolesterolemia. Hal ini dapat diklasifikasikan ke dalam steroid NS sensitif dan resisten. Relaps yang umum di NS sensitif steroid selama Years pertama setelah mereka mendapat didiagnosis. Tujuan dari penelitian ini adalah untuk mengetahui distribusi penderita NS yang bisa kambuh berdasarkan jenis kelamin, usia, Total kambuh, Blood Pressure, hematuria, laju filtrasi glomerulus (GFR), albumin, dan kolesterol. Penelitian ini merupakan penelitian deskriptif observasional dilakukan dengan total sampling untuk mendapatkan sampel. Sampel anak usia 1-18 Years dengan sindrom nefrotik yang mendapat kambuh selama Years pertama setelah mereka didiagnosis di Rumah Sakit Dr. Soetomo Surabaya Januari 2001 - Desember 2011. Ada kambuh ditemukan pada 35 pasien yang 29 pasien (82,8%) adalah Male dan 6 pasien (17,2%) adalah Female. Ada 27 kambuh non-sering (77,1%) dan 8 kambuh sering (22,9%). Ada 27 pasien (77,1%) berusia 1-6 Years, 7 pasien (20%) berusia 7-12 Years, dan 1 pasien (2,9%) berusia 13-18 Years. Bergizi baik ditemukan pada 26 pasien (74,2%), kurang gizi yang ditemukan pada 4 pasien, berat kurang gizi ditemukan dalam 4 pasien (11,5%), kelebihan berat badan ditemukan di 0 pasien (0%), dan obesitas yang ditemukan pada 1 pasien (2,8%). Ada 18 pasien (51,5%) dengan Hypertension dan 17 pasien (48,5%) adalah normal. Hematuria hanya ditemukan di 5 pasien (14,3%) ketika 30 pasien lainnya (85,7%) tidak. Rendah albumin serum ditemukan pada 29 pasien (82,9%) dan 6 pasien (17,1%) adalah normal. GFR yang rendah ditemukan pada 8 pasien (22,9%) dan 27 pasien (77,1%) nilai normal. Kolesterol serum meningkat pada 32 pasien (91,5%) ketika 3 orang normal (8,5%). Kesimpulannya, ada lebih kambuh non-sering daripada yang sering kambuh dan juga lebih banyak pria daripada wanita. Kambuh umumnya ditemukan pada pasien berusia 1-6 Years. Kebanyakan dari mereka adalah cukup gizi. Beberapa dari mereka mengalami Hypertension dan hematuria. Tingkat GFR yang rendah ditemukan pada beberapa pasien. Penurunan serum albumin dan peningkatan kolesterol serum yang umum dialami pasien yang mengalami kekambuhan. ***(FMI 2012;48:180-185)***

Kata kunci: *profil klinis, sindrom nefrotik sensitif steroid, relaps, Years pertama*

ABSTRACT

Nephrotic Syndrome (NS) is characterized by massive proteinuria, hypoalbuminemia, accompanied by oedema, and hypercholesterolemia. It can be classified into steroid sensitive and resistant NS. Relapses were common in steroid sensitive NS during the first year after they got diagnosed. The aim of this study is to know the distribution of NS patients who get relapsed based on gender, age, number of relapses, blood pressure, hematuria, glomerular filtration rate (GFR), albumin, and cholesterol. This was an observational descriptive study was performed with a total sampling to obtain the sample. Sample is children aged 1-18 years with nephrotic syndrome who got relapse during the first year after they were diagnosed in Dr. Soetomo Hospital Surabaya January 2001 – December 2011. There are relapses found in 35 patients in which 29 patients (82,8%) are male and 6 patients (17,2%) are women. There are 27 non-frequent relapsers (77,1%) and 8 frequent relapsers (22,9%). There were 27 patients (77,1%) aged 1-6 years, 7 patients (20%) aged 7-12 years, and 1 patient (2,9%) aged 13-18 years. Well-nourished is found in 26 patients (74,2%), under-nourished are is found in 4 patients, severe malnourished is found in 4 patients (11,5%), overweight is found in 0 patient (0%), and obesity found in 1 patient (2,8%). There are 18 patients (51,5%) with hypertension and 17 patients (48,5%) are normal. Hematuria is only found in 5 patient (14,3%) when the other 30 patients (85,7%) are not. Low albumin serum found in 29 patients (82,9%) and 6 patients (17,1%) were normal. Low GFR was found in 8 patients (22,9%) and 27 patients (77,1%) in normal value. Cholesterol serum is elevated in 32 patients (91,5%) when the 3 others are normal (8,5%). In conclusion, there are more non-frequent relapsers than frequent relapsers and also more men than women. Relapses commonly found in patients aged 1-6 years. Most of them are well nourished. Some of them are having hypertension and hematuria. Low GFR level was found in a few patients. Decreased in albumin serum and elevation of cholesterol serum are common in relapsing patients. ***(FMI 2012;48:180-185)***

Keywords: *Clinical profile, steroid sensitive nephrotic syndrome, relapse, first year.*

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INTRODUCTION

Nephrotic syndrome (SN) is known as a common chronic disease in children suffered. The incidence of nephrotic syndrome in children in western countries amounted to 2-3 per 100,000 births in 1 year (Eddy & Symons, 2003). Whereas, in developing countries the incidence is higher. In Indonesia reported 6 per 100,000 per year in children aged less than 14 years with a ratio of boys and girls 2: 1 (Trihono et al, 2008). Based on the cause, SN is divided into three, namely congenital, primary or idiopathic, and secondary (Trihono et al 2008). Typical characteristics obtained from nephrotic syndrome derived from selective permeability changes glomerular capillary wall (glomerular capillary wall), causing many plasma proteins lost from the body due to renal glomerular filtration process (Eddy & Symons, 2003).

Characteristics of a person suffering from nephrotic syndrome is massive proteinuria (> 3.5 g / 24 hours in adults or 40 mg / m2 / h in children), hypoalbuminemia (<2.5 g / dL), edema anasarca, and hyperlipidemia (Kliegman et al 2007). In some patients with nephrotic syndrome, hematuria obtained related to the incidence of relapse (relapse), and also hypertension due to steroid toxicity (Noer, 2005, Trihono et al 2008). Idiopathic nephrotic syndrome is a disease most commonly found glomerulopathy. Most of them will experience frequent relapses of nephrotic syndrome, steroid dependent or steroid resistant. Children in the past three groups will get complications caused by the treatment given and due to the disease (Trihono et al 2008). In the long-term research turns response to steroid treatment is often used to determine prognosis compared with anatomic pathology. On the basis that the current classification is based on the SN clinical response is: Steroid Sensitive Nephrotic Syndrome (SNSS) and Steroid Resistant Nephrotic Syndrome (SNRs) (Trihono et al 2008).

Ninety percent of SN in children is a primary and histopathologically SN 88% of them showed minimal change that responds to steroids, but about 60-80% will experience a relapse that half of them in the form of frequent relapses (frequent relapser) or steroid dependent. Nephrotic syndrome who experienced a relapse is a big problem because there can be complications, either from the disease itself as well as the possibility of steroid toxicity, or histopathological changes into a non-minimal abnormalities (Aaron et al 2006). Prevention needs to be done as early as possible so that children with nephrotic syndrome do not relapse that may cause complications related to health and psychological effects that can be caused. Therefore, we need information about the clinical profile of children with idiopathic nephrotic syndrome who relapse. The purpose of this study is to describe the clinical profile of children with idiopathic steroid-sensitive nephrotic syndrome (SNSS) who relapse in the first year at the Hospital Dr. Soetomo the period January 2001 - December 2011.

MATERIALS AND METHODS

This was a non-experimental study with observations to obtain data on clinical profile of children with idiopathic steroid-sensitive nephrotic syndrome who experienced a relapse in the first year. Materials used in this study was a document medical records of all patients with idiopathic nephrotic syndrome in children who never went to Nephrology Clinic, Department of Child Health, Dr Soetomo Hospital, from January 2001 to December 2011. The study population was children with idiopathic steroid-sensitive nephrotic syndrome who experienced relapse in the first year and never went to Nephrology Clinic, Department of Child Health, Dr Soetomo Hospital, from January 2001 to December 2011.The entire study population sample (total sample)

Inclusion criteria were patients with steroid-sensitive nephrotic syndrome who received steroid therapy and relapse in the first year, patients with idiopathic nephrotic syndrome with a lifespan of 1-18 years were treated in Nephrology Clinic, Department of Child Health, Dr Soetomo Hospital, from January 2001 to December 2011, patients with idiopathic nephrotic syndrome who had been treated at least 1 year in Hospital Dr Soetomo period January 2001-December 2011, and patients with complete medical records. Exclusion criteria were patients with secondary nephrotic syndrome, congenital and infantile, and resistant to steroids, and patients who do not complete MEET inclusion criteria. Data collection techniques in this research used secondary data obtained by medical record of entire pediatric patients (1-18 years) with idiopathic nephrotic syndrome treated with a minimum follow-up of 1 year at Nephrology Clinic, Department of Child Health, Dr Soetomo Hospital, from January 2001 to December 2011. Data on the observation of a medical record that has been gathered, then processed and analyzed descriptively, for interval scale data and used the Mean and SD, while nominal scale data used for cross tabulation percentages. Here is an example of a dummy table that will be presented in the research.

RESULTS

The first attack in 1-6 years of age have the most percentage (77.1%). While the 13-18 year age group had the smallest percentage (2.9%). Comparison SNSS

in patients with hypertension (51.5%) when relapse was almost as high as that in those without hypertension (48.5%). Most of the SNSS patients who relapse have a good nutritional status (76.42%) while the least is that having more nutrition (0%). A small portion of patients who relapse obtained SNSS hematuria (14.3%) at the time of examination urinalysis. While most do not experience hematuria when relapse (85.7%).

Table 1. Frequency Distribution of Relapse based on Sex

Sex	Relapse Frequency		Total
	Infrequent Relapse	Frequent Relapse	
Male	22	7	29 (82.8%)
Female	5	1	6 (17.2%)

Table 2. Frequency of Relapses based on Age Distribution of First Onset

Age of First Onset	Relapse Frequency		Total
	Infrequent Relapse	Frequent Relapse	
1-6 Years	23	4	27 (77.1%)
7-12 Years	3	4	7 (20%)
13-18 Years	1	0	1 (2.9%)

Table 3. Frequency of Relapses based on Blood Pressure

Blood Pressure	Relapse Frequency		Total
	Infrequent Relapse	Frequent Relapse	
Normal	13	4	17 (48.5%)
Hypertension	14	4	18 (51.5%)

Table 4. Frequency of Relapse based on Nutritional Status

Nutritional Status	Relapse Frequency		Total
	Infrequent Relapse	Frequent Relapse	
Malnutrition	2	2	4 (11.5%)
Undernutrition	3	1	4 (11.5%)
Optimal Nutrition	22	4	26 (74.2%)
Overnutrition	0	0	0 (0%)
Obesity	0	1	1 (2.8%)

Table 5. Frequency of Relapse based on Haematuria

Hematuria	Relapse Frequency		Total
	Infrequent Relapse	Frequent Relapse	
Positive	4	1	5 (14.3%)
Negative	23	7	30 (85.7%)

Table 6. Frequency of Relapses based on Serum Albumin

Albumin Serum	Relapse Frequency		Total
	Infrequent Relapse	Frequent Relapse	
Normal	6	0	6 (17.1%)
Decreased	21	8	29 (82.9%)

Table 7. Frequency of Relapse based on Glomerular Filtration Rate

Glomerular Filtration Rate	Relapse Frequency		Total
	Infrequent Relapse	Frequent Relapse	
Normal	21	6	27 (77.1%)
Decreased	6	2	8 (22.9%)

Table 8. Frequencyof Relapse based on Serum Cholesterol

Cholesterol Serum	Relapse Frequency		Total
	Infrequent Relapse	Frequent Relapse	
Normal	3	0	3 (8.5%)
Increased	24	8	32 (91.5%)

Most patients with relapsed SNSS had decreased serum albumin (82.9%), while a small portion is did decrease (17.1%). Most patients SNSS decreased GFR (22.9%) while the majority of both rare and relapse relapse often not decreased GFR (77.1%). Most of the patients had increased serum cholesterol were quite significant (91.5%), while only a small percentage of patients who did not experience an increase in serum cholesterol (8.5%).

DISCUSSION

Research on the clinical profile of children with Idiopathic Nephrotic Syndrome Steroid Sensitive (SNSS) who relapse in the first year is done on Poly Child Nephrology Outpatient Installation (IRJ) Hospital Dr. Soetomo in the period January 2001 to December 2011. This study was done descriptively by processing the data contained in the documents that are in the medical health Poly IRJ Child Nephrology Hospital Dr. Soetomo which is the referral hospital for the region of Eastern Indonesia.

This study uses data of patients with idiopathic steroid-sensitive nephrotic syndrome who relapse for the first time within a period of 1 year after diagnosis before the first attack. This research aims to study the characteristics of data SNSS relapse in children with clinical and laboratory include: gender, age of first attack, nutritional status, relapse frequency, blood

pressure, hematuria, serum albumin, glomerular filtration rate, and serum cholesterol as it has been formulated in the introduction. Obtained 35 samples studies met the inclusion criteria and study variables. Of 35 existing samples, 27 samples with relapsing nephrotic syndrome rarely and 8 samples with frequently relapsing nephrotic syndrome.

Idiopathic nephrotic syndrome is a kidney disease cases are quite common in children than adults. Most of them will experience a relapse later grouped into relapse and relapse rarely often based on the incidence of first relapse within 1 year after they are diagnosed. Table 1 describes the distribution of the frequency of relapses of the sexes, which can be seen from the table that the number of male patients either relapsed or relapsed rarely found more frequently than the female gender which 22 (81.4%) of 27 patients with nephrotic syndrome relapse rare and 7 (87.5%) of 8 patients with relapsing nephrotic syndrome often. In total, 29 patients were male (82.8%) and 6 were female (17.2%).

Various studies have been conducted in children with steroid sensitive nephrotic syndrome who relapsed in the first year. These results are supported by Linawaty & Kusuma (2012) in Jogjakarta, where from 31 patients studied 22 (70.9%) of them were males and 9 (29.1%) were female. Research conducted by Noer (2005) in Surabaya, obtained 63 patients experienced a relapse which 48 (76.2%) of them were men and 15 were women. (23.8%). A similar study conducted by Anonymous (1978) included 467 children in which 317 (68%) of the children of them were male. Through the comparison study mentioned above can be seen that the nephrotic syndrome patients who relapse relapse mostly rare and gender is male dominated both in patients with relapsing rare and frequent relapses.

Age first attack (age when the patient was first diagnosed with SN) were divided into 3 groups namely the age of 1-6 years, 7-12 years, and 13-18 years. In this study discussed relapse frequency distribution of the age of the first attack in Table 2. From this table, it can be seen that 27 (77.1%) were in group 1-6 years. Takeda et al (2001) refer to ISKDC (International Study of Kidney Disease in Children) explained that the steroid-sensitive nephrotic syndrome patients who relapse have a first attack age of 4.5 years. Research Noer (2005) presented on 50 patients relapse rarely, 30 (60%) of them were in the age group under 6 years and 11 (84.6%) of 13 patients with relapse often also be in the age group under 6 years. Through the above data it can be concluded that the incidence of relapse was higher in the age group 1-6 years compared to the age group 7-12 years and 13-18 years so that later required a more serious concern in patients with nephrotic syndrome who are in the age group 1-6 years. Nephrotic syndrome is a disorder found as many as 15 times in children than adults and up to now have not found an explanation for why the pathogenesis of nephrotic syndrome is obtained much more incidence in children (Trihono et al 2008).

Nutritional status in patients relapse and relapse rarely often determined based on anthropometric indices TB / U (Height by Age) by using a z-score of the WHO in 2007 to include developing countries. Table 3 describes the frequency distribution of relapse on nutritional status. Through the above table it can be seen that as many as 22 (81.5%) of 27 patients with relapse rarely categorized had enough nutrition. Similarly, in patients with frequent relapses 4 of 8 categorized enough nutrition. Research conducted by Noer (2005) explained that most patients relapse and relapse often categorized rarely enough nutrition.

This study uses the determination of nutritional status using a percentile which is then converted into an ideal body weight. Although obtain uniformity in the nutritional status of the existing categories, but have a different meaning to the determination of nutritional status based on the percentile and anthropometric indices were used. Nutrition in children with nephrotic syndrome is important and deserves attention, especially in children with frequently relapsing nephrotic syndrome or steroid dependent can undergo steroid toxicity. Need monitoring of the status of growth and endocrine function to the patient as well as the quality and quantity of macro and micro nutrients (Rees et al 1988).

Blood pressure is one of the clinical examination were included in the study variables. Table 4 shows relapse frequency distribution of the blood pressure profile which is owned by the patient where the majority of patients have elevated blood pressure (51.5%). It is known that the definition of hypertension is systolic or diastolic blood pressure greater than or equal to the 95th percentile (Trihono et al 2008). Research conducted by Subandiyah (2004) explained that as many as 19 (25.3%) of 75 patients with steroid-sensitive nephrotic syndrome diagnosed hypertension. While the research conducted by Noer (2005) explained that 3 (23.1%) of 13 patients with relapsed frequently had hypertension at the time of relapse and 9 (18%) of 41 patients with relapse rarely have hypertension. while the data that has been processed by the researchers shows the percentage of children who suffer from hypertension increased to 14 (51.9%) of 27 patients with relapsing rarely and 4 (50%) of 8 patients often relapse. Research conducted by Raisania et al (2012) explained that 11 (47.8%) of 23 patients with frequent relapses and steroid resistant hypertension, according to 2 (20%) of patients relapse

rarely experienced the same thing. Through the comparison of the results obtained above percentage increase compared with that done by other researchers one of them due to differences in the amount of data that is quite significant between one another. Hypertension in the nephrotic syndrome can be found in patients who relapse earlier. Corticosteroids may cause hypertension through ocorticoid mineral effect is to increase the retention of sodium and water in the kidney, plasma volume expansion, and ultimately increase blood pressure (Ferrari 2003). Assessment and monitoring of the blood pressure of patients with nephrotic syndrome relapse is important to do because it would otherwise cause a disturbance on cardiovascular function. This is supported by research conducted by Widjaja et al (2007) that showed a significant association between ventricular enlargement of the heart to increase blood pressure in children with frequently relapsing nephrotic syndrome or steroid dependent.

Microscopic hematuria was found in 20-30% of cases of nephrotic syndrome, hematuria while macroscopically very rare (Kasper et al 2004). Table 1 shows obtained lower percentage who experience hematuria. Obtained 5 (14.3%) of the 30 (85.7%) patients experienced a relapse of hematuria. Research conducted by Sinha et al (2012) explained that 85 (7.9%) of the 1071 sample nephrotic syndrome rarely relapse, relapse frequently, steroid dependent and steroid-resistant. While Noer (2005) in his research in Surabaya explained that 3 (23.1%) of 13 patients with frequent relapses and 6 (12%) of the 50 patients experienced a relapse rarely hematuria at the time of relapse. Obtained uniformity percentage obtained by researchers when compared with other studies. The discovery of macroscopic hematuria in idiopathic nephrotic syndrome should be considered the possibility of renal vein thrombosis, although many causes of hematuria. Glomerular etiology reveals a picture of dysmorphic erythrocytes or erythrocyte cylinders or granular form (Handayani et al 2007).

Low serum albumin is one of the important indicators in the monitoring of patients with nephrotic syndrome. Decreased serum albumin (hypoalbuminemia) may cause edema Anasarca and hypovolemia due to extravasation of intravascular fluid into the interstitial (Trihono et al 2008). In Table 2 it can be seen that 6 (17.1%) of 35 patients had normal serum albumin, while most of the decreased serum albumin. In patients relapse is rare 6 people have normal albumin levels, it is probably because the data retrieved SN researchers are patients who are already undergoing treatment, so that among them there is the possibility to experience improvement.

Handayani et al (2007) also found similar things. Hypoalbuminemia occurs due to increased re-absorption (reabsorption) and catabolism of albumin by proximalis tubules, although this is disputed (controversial). Improved decision-protein causes increased glomerular pressure, related to an increasing number of proteins that pass into the urine (urine), so that serum albumin decreases. In addition, hypoalbuminemia was also caused by the production of albumin by the liver can not compensate for the amount of protein that is discarded (Handayani et al 2007). Research conducted by Garniasih et al (2008) explains that a significant association between hypoalbuminemia due to serum albumin as a calcium binding protein that binds to calcium lost in the urine. Therefore, it is indispensable for monitoring serum albumin when patients relapse to prevent complications that can arise (Anasarca edema, hypovolemia, hypocalcemia) (Trihono et al 2008).

Glomerular filtration rate (GFR) is one of the checks that are used to assess kidney function using the formula that requires data Scwartz serum creatinine, height, as well as in the formula using constant. Table 3 describes LFG owned by infrequent and frequent relapse. A total of 8 (22.9%) of 35 patients had a relapse decreased glomerular filtration rate. Research conducted by Hofstra et al (2011) discusses the various methods of measurement used to determine GFR in patients with nephrotic syndrome that is using the MDRD formula complete and simplified MDRD as well. Research results showed significant differences in interpretation LFG when patients had hypoalbuminemia. Branten et al (2005) in his study also explained that serum albumin to creatinine secretion by determining the renal tubules that influence creatinine clearance so it can happen that less precise assessment of the LFG patients with low serum albumin. Through this study, it is expected that clinicians be aware of the limitations of the method of measurement of serum creatinine-based GFR Hyper-lipidemia is that found in children with nephrotic syndrome relapse. It is commonly found in patients with severe proteinuria. Also found irregularities increased synthesis of HDL, LDL, and VLDL in the liver (Handayani et al 2007). Table 4 describes the frequency of relapses of the serum total cholesterol which there are 32 (91.5%) of 35 patients had elevated serum cholesterol. Research conducted by Baskoro (2011) explained that total cholesterol levels before and after steroid therapy has a significant difference, which obtained blood total cholesterol levels were lower after treatment than before treatment just not the data included serum cholesterol when relapse. While the research was done by Widjaja et al (2007) found all patients relapse frequently and steroid dependent have increased serum cholesterol and is associated with increased intima-media thickness of the carotid artery.

Hypercholesterolemia is settled frequently found in patients with frequent relapses. This was investigated by Lawang et al (2008) to obtain the conclusion that the plasma levels increased blood lipids associated with an increased risk of relapse in children with nephrotic syndrome. Monitoring of serum cholesterol is essential to prevent further complications.

CONCLUSION

From research conducted at Nephrology Clinic , Department of Child Health, Dr. Soetomo Hospital, revealed data showing that there were 35 patients with steroid-sensitive nephrotic syndrome relapse in the first year of the period January 2001 - December 2011 of which 27 are rare relapses and 8 of them are frequent relapses. Gender male earned more than women. Nephrotic syndrome patients who relapse have the highest incidence in group 1-6 years and most have good nutritional status based on anthropometric indices Height/Age. In addition, most patients with hypertension obtained, as well as a small portion of hematuria currently experiencing relapse. As well as a decrease in serum albumin obtained dominance and increased serum cholesterol and a slight decrease in GFR in patients with nephrotic syndrome.

REFERENCES

Anonymous (1978). Nephrotic syndrome in children: prediction of histopathology from clinical and laboratory characteristics at time of diagnosis. A report of the International Study of Kidney Disease in Children. Kidney Int 13, 159-165

Baskoro AG (2011). Kadar kolesterol darah anak penderita sindrom nefrotik sensitif steroid sebelum dan sesudah terapi prednison dosis penuh. Bachelor Thesis. Universitas Diponegoro, Semarang

Branten AJ, Vervoort G, Wetzels JF (2005). Serum creatinine is a poor marker of GFR in nephrotic syndrome. Nephrol Dial Transplant 20, 707-711

Eddy AA and Symons JM (2003). Nephrotic syndrome in childhood. Lancet 362, 629-639

Ferrari P (2003). Cortisol and the renal handling of electrolytes: role in glucocorticoid-induced hypertension and bone disease. Best Pract Res Clin Endocrinol Metab 17, 575-589

Garniasih D, Djais JTB, Garna H (2008). Hubungan antara kadar albumin dan kalsium serum pada sindrom nefrotik anak. Sari Pediatri 10, 100-105

Handayani I, Rusli B, Hardjoeno (2007). Profile of cholesterol and albumin concentration and urine sediment based on nephrotic syndrome children. Indonesian Journal of Clinical Pathology and Medical Laboratory 13, 49-52

Harun MS, Sekarwana N, Sambas DR, Hilmanto D (2006). Korelasi antara hipoalbumenia dan peningkatan kadar lipoprotein(A) pada anak yang menderita sindrom nefrotik kambuh. Jurnal Bionatura 8, 303-311

Hofstra JM, Willems JL, Wetzels JF (2011). Estimated glomerular filtration rate in the nephrotic syndrome. Nephrol Dial Transplant 26, 550-556

Kasper DL, Braunwald E, Fauci AS, Hauser S, Longo D, Jameson JL (2004). Harrison's Principles of Internal Medicine, 16th ed, New York, McGraw-Hill Professional

Kliegman RM, Behrman RE, Jenson HB, Stanton BF (2007). Nelson Textbook of Pediatrics, 18th ed, Philadelphia, Elsevier Saunders

Lawang SA, Rauf S, Lisal JS, Albar H, Daud D (2008). Plasma lipids as risk factors in relapsing nephrotic syndrome. Paediatrica Indonesiana 48, 322-326

Linawaty and Kusuma PA (2012). Kadar imunoglobulin G pada anak dengan sindrom nefrotik primer sensitif steroid dan resisten steroid. Master Thesis. Universitas Gadjah Mada, Yogyakarta

Noer MS (2005). Predictors of relapse in steroid-sensitive nephrotic syndrome. Southeast Asian J Trop Med Public Health 36, 1313-1320

Raisania I, Muryawan MH, Radityo AN (2012). Hubungan antara terapi kortikosteroid dengan kejadian Hypertension pada anak dengan sindrom nefrotik. Bachelor Thesis. Universitas Diponegoro, Semarang

Rees L, Greene SA, Adlard P, Jones J, Haycock GB, Rigden SP, Preece M, Chantler C (1988). Growth and endocrine function in steroid sensitive nephrotic syndrome. Arch Dis Child 63, 484-490

Sinha A, Hari P, Sharma PK, Gulati A, Kalaivani M, Mantan M, Dinda AK, Srivastava RN, Bagga A (2012). Disease course in steroid sensitive nephrotic syndrome. Indian Pediatr 49, 881-887

Subandiyah K (2004). Outcome sindrom nefrotik pada anak – penelitian prospektif studi cohort. Jurnal Kedokteran Brawijaya 20, 147-151

Takeda A, Takimoto H, Mizusawa Y, Simoda M (2001). Prediction of subsequent relapse in children with steroid-sensitive nephrotic syndrome. Pediatr Nephrol 16, 888-893

Trihono PP, Alatas H, Tambunan T, Pardede SO (2008). Konsensus Tata Laksana Sindrom Nefrotik Idiopatik pada Anak, 2nd ed, Jakarta, Badan Penerbit Ikatan Dokter Anak Indonesia

Widjaja SL, Advani N, Tambunan T (2007). Ketebalan tunika intima-media arteri karotis dan fungsi ventrikel serta profil lipid pada anak dengan sindrom nefrotik relaps frekuen dan dependen steroid. Sari Pediatri 9, 285-292