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A Review on Nephrotic Syndrome in Children

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ABSTRACT

Context: Nephrotic syndrome is a common pediatric kidney disease which is characterized by the leakage of the protein from the blood into urine through the damaged glomeruli. Nephrotic syndrome is characterized by heavy proteinuria, hypoalbuminemia (serum albumin <2.5g/dl), hyperlipidemia (serum cholesterol >200mg/dl) and edema. Nephrotic range proteinuria is present if early morning urine protein is 3+/4+ (on dipstick test), spot protein/creatinine ratio >2mg/mg or >200mg/mmol urine albumin excretion >40 mg/m² per hour. Precise quantitative measurement is necessary by 24 hour urine protein measurement.

Epidemiology: Occurs at all age groups but most common in children of one year five months to six years

Boys>Girls, 2:1 ratio, Higher in underdeveloped countries, Incidence worldwide, 2-7 cases per 100,000 children /year.

Discussion: Nephrotic syndrome happens when tiny structures in the kidneys called glomeruli stop working properly and let too much protein enter the kidneys. Signs of nephrotic syndrome may vary significantly from child to child, but you or your child may notice: fatigue, malaise, decreased appetite, weight gain and facial swelling. A number of conditions can damage the glomeruli and cause nephrotic syndrome. In children, the most common cause is due to minimal change disease. The treatment's goal is to stop the loss of protein in the urine and increase the amount of urine passed from the body. Prednisolone is the first choice of drug given followed by immunomodulators; additional drugs like ACE inhibitors, diuretics, HMG COA inhibitors are also prescribed.

Conclusion: Nephrotic syndrome happens when tiny structures in the kidneys called glomeruli stop working properly and let too much protein enter the kidneys. Signs of nephrotic syndrome may vary significantly from child to child, but you or your child may notice: fatigue, malaise, decreased appetite, weight gain and facial swelling. A number of conditions can damage the glomeruli and cause nephrotic syndrome. In children, the most common cause is due to minimal change disease. The treatment's goal is to stop the loss of protein in the urine and increase the amount of urine passed from the body. Prednisolone is the first choice of drug given followed by immunomodulators; additional drugs like ACE inhibitors, diuretics, HMG COA inhibitors are also prescribed.

Keywords: Nephrotic, immunomodulators, syndrome, fatigue, diuretics.

INTRODUCTION

Nephrotic syndrome is a common pediatric kidney disease which is characterized by the leakage of the protein from the blood into urine through the damaged glomeruli. This is a syndrome caused by renal diseases that increase the permeability across the glomerular filtration membrane. Healthy kidneys help to retain proteins in the blood but damaged kidneys leaks proteins into urine, and as a result not enough protein is left in the blood to soak water. Both adults and children can be affected with nephrotic syndrome. Causes and treatment of nephrotic syndrome in children are different from adults. Childhood nephrotic syndrome is mostly characterized by minimal change disease. It can occur at any age but is most common between age groups of 1 year 5 months and 6 years. It is more likely to affect boys more than girls.[1, 2]

A child with nephrotic syndrome has these characteristics:

- High levels of protein in urine, a condition called as proteinuria
- Low levels of protein in blood
- Swelling due to excess buildup of salt and water
- Less frequent urination
- Weight gain from excess water [2]

Nephrotic syndrome is characterized by heavy proteinuria, hypoalbuminemia (serum albumin <2.5g/dl), hyperlipidemia (serum cholesterol >200mg/dl) and edema. Nephrotic range proteinuria is present if early morning urine protein is 3+/4+ (on dipstick test), spot protein/creatinine ratio >2mg/mg or >200mg/mmol urine albumin excretion >40 mg/m² per hour. Precise quantitative measurement is necessary by 24 hour urine protein measurement [2,3].

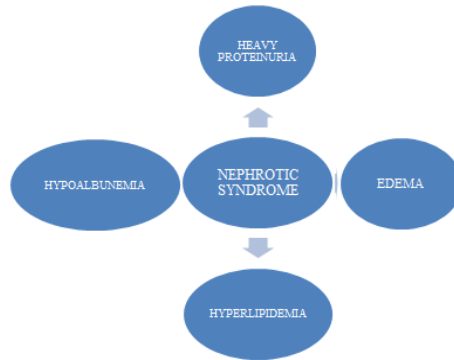


Figure 1: Characterization of Nephrotic Syndrome.

EPIDEMIOLOGY

Occurs at all age groups but most common in children of one year five months to six years

- Boys>Girls, 2:1 ratio
- Higher in underdeveloped countries
- Incidence worldwide, 2-7 cases per 100,000 children /year [3]

Causes of nephrotic syndrome:

- Most children with nephrotic syndrome have "minimal change disease". This means that their kidneys appear normal or nearly normal if a tissue sample is studied under a microscope. The cause of minimal change disease is unknown.
- Nephrotic syndrome can sometimes occur as a result of a kidney problem or another condition, such as:
- Glomerulosclerosis-when the inside of the kidney becomes scarred
- Glomerulonephritis-inflammation inside the kidney
- An infection-such as HIV or hepatitis
- Lupus
- Diabetes
- Sickle cell anemia
- In very rare cases, certain types of cancer – such as leukemia, multiple myeloma or lymphoma [4, 5]

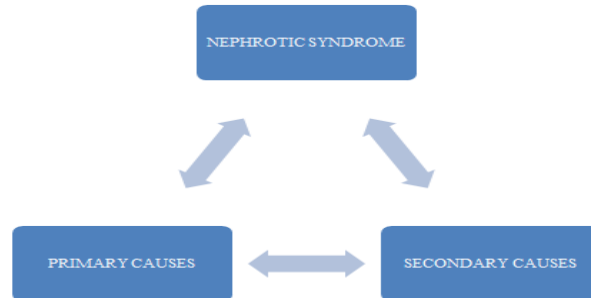


Figure 2: Causes of Nephrotic syndrome.

Primary Causes	Minimal change disease
	Membrane glomerulonephritis
	Membranoproliferative glomerulonephritis
	Rapidly Progressive glomerulonephritis
	Focal glomerulosclerosis
Secondary Causes	Systemic lupus erythematosus
	Diabetes mellitus
	Bacterial infection
	Drugs like Nsaids

Table 1: Primary and secondary causes Nephrotic syndrome

1.Urine analysis
2.Urine Sediment Examination
3.24 hr Urinary Protein Measurement
4.Serum Albumin
5.Serological Studies For Infections
6.Renal Ultrasonography
7.Renal Biopsy
8. Complete Blood Count, Blood Levels Of Albumin, Cholesterol, Urea, And Creatinine.
9.Tubercuin Test
10.Electrolytes

Table 2: Laboratory investigations

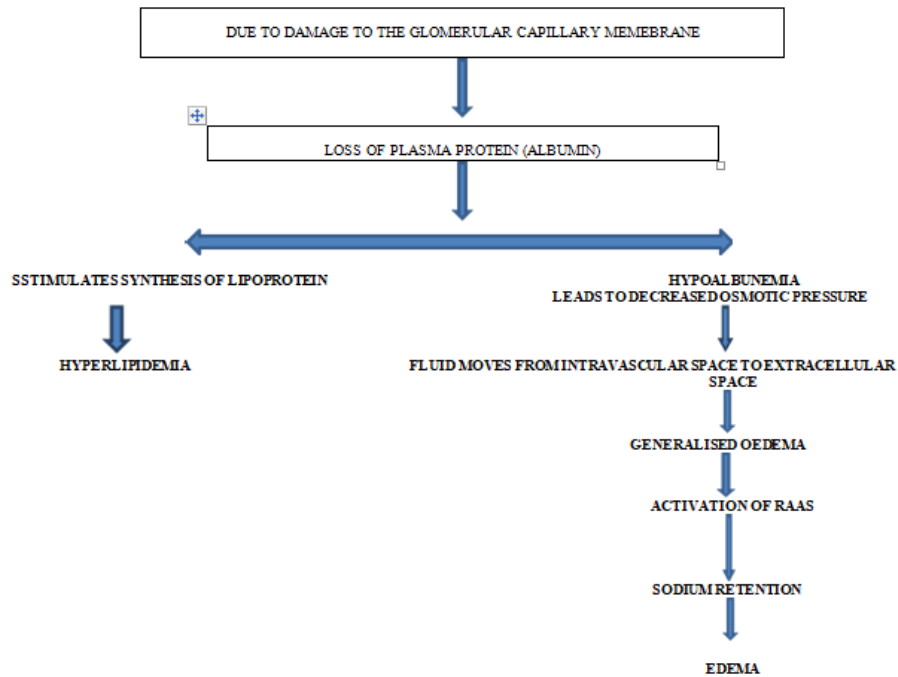


Figure 3: Pathophysiology of nephritic syndrome.

Serum proteins	protein excretion greater than 3.5 g/24 hours
Albumin	less than 3 g/dL or 30g/l
Lipids(serum cholesterol)	>200mg/dl
Dipstick test	A 3+reading represents 300 mg/dL of urinary protein or more, which correlates with a daily loss of 3 g or more and thus is in the nephrotic range.
spot protein/creatinine ratio	>2mg/mg, >200mg/mmol
urine albumin excretion	>40 mg/m ² per hour
Edema	Pitting edema is the presenting symptoms in about 95% of children with nephrotic syndrome. Edema is typically found in the lower extremities, face and peri orbital regions, scrotum or labia, and abdomen (ascites)

Table 3: Abnormality in laboratory values observed in children.

CLINICAL MANIFESTATIONS

Most children with nephrotic syndrome have times when their symptoms are under control (remission), followed by times when symptoms return (relapses).



Figure 4: Some of the main symptoms associated with nephrotic syndrome include.

- Swelling-Swelling is usually first noticed around the eyes (peri orbital), then around the lower legs and the rest of the body.
- Infections
- Urine changes-occasionally, the high levels of protein being passed into the urine can cause it to become frothy. Some children with nephrotic syndrome may also pass less urine than usual during relapses.
- Blood clots-important proteins that help prevent the blood clotting can be passed out in the urine of children with nephrotic syndrome. This can increase their risk of potentially serious blood clots.
- Extreme tiredness (fatigue)
- A general feeling of discomfort (malaise)
- Decreased appetite.
- Fluid buildup in the body (edema)
- Fluid buildup in the belly area (ascites) [4,5]

Complications

Infections: Prone to develop primary peritonitis and systemic infection due to urinary loss & inefficient production of immune globulins, defective cell mediated immunity and use of immune suppressive drugs.

Hyperlipidemia: It may be due to increases hepatic synthesis of lipoproteins secondary to hypoalbuminemia. Hyperlipidemia may lead to platelet aggregates and risk of renal vein thrombosis.

Electrolyte disturbances: Hyponatremia, hyperkalemia and hypocalcaemia. Hypocalcaemia as result of reduction of protein bound calcium

secondary to hypoalbuminemia, urinary loss of D-binding globulin, 25-hydroxyvitamin D3 and further aggravated by prolonged corticosteroids therapy.

Acute renal failure: It is due to intrinsic glomerular damage in atypical nephrotic syndrome. These patients are very sensitive to reduction of blood volume. As result of diarrhea, vomiting or rapid diuresis they can develop hypovolemic shock and pre renal azotemia promptly managed by administration of albumin or plasma to prevent renal dysfunction [5].

Management

- Appropriate therapy at the first episode is an important determinant of the long term course of the disease.
- Prednisolone is the drug of choice
- It is given at a dose of 2 mg/kg per day (max 60mg in single or divided doses) for 6 weeks, followed by 1.5mg/kg (max 40mg) as a single morning dose on alternate days for the next 6 weeks, therapy is then discontinued [6,7].

DISCUSSION

Nephrotic syndrome happens when tiny structures in the kidneys called glomeruli stop working properly and let too much protein enter the kidneys. Signs of nephrotic syndrome may vary significantly from child to child, but you or your child may notice: fatigue, malaise, decreased appetite, weight gain and facial swelling. A number of conditions can damage the glomeruli and cause nephrotic syndrome. In children, the most common cause is due to minimal change disease. The treatment's goal is to stop the loss of protein in the urine and increase the amount of urine passed from the body. Prednisolone is the first choice of drug given followed by immunomodulators; additional drugs like ACE inhibitors, diuretics, HMG COA inhibitors are also prescribed [7,8].

CONCLUSION

Most children having nephrotic syndrome are characterized by minimal change disease. There may be primary and secondary causes associated with the occurrence of nephrotic syndrome. Most common symptoms include: fatigue and malaise. Decreased appetite, weight gain and facial swelling. Nephrotic syndrome can be managed with the use of steroid therapy and immunomodulators along with additional drugs like ACE inhibitors, diuretics, HMG COA inhibitors.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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