Childhood Nephrotic Syndrome

What is nephrotic syndrome?

Nephrotic syndrome is a set of signs or symptoms that may point to kidney problems. The kidneys are two bean-shaped organs found in the lower back. Each is about the size of a fist. They clean the blood by filtering out excess water and salt and waste products from food. Healthy kidneys keep protein in the blood, which helps the blood soak up water from tissues. But kidneys with damaged filters may leak protein into the urine. As a result, not enough protein is left in the blood to soak up the water. The water then moves from the blood into body tissues and causes swelling.

Both children and adults can have nephrotic syndrome. The causes of and treatments for nephrotic syndrome in children are sometimes different from the causes and treatments in adults. For information about nephrotic syndrome in adults, see the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) publication Nephrotic Syndrome in Adults.

Childhood nephrotic syndrome can occur at any age but is most common between the ages of 1½ and 5 years. It seems to affect boys more often than girls.

A child with nephrotic syndrome has these signs:

- high levels of protein in the urine, a condition called proteinuria
- low levels of protein in the blood
- swelling resulting from buildup of salt and water
- less frequent urination
- weight gain from excess water

Nephrotic syndrome is not itself a disease. But it can be the first sign of a disease that damages the kidney’s tiny blood-filtering units, called glomeruli, where urine is made.

How is childhood nephrotic syndrome diagnosed?

To diagnose childhood nephrotic syndrome, the doctor may ask for a urine sample to check for protein. The doctor will dip a strip of chemically treated paper into the urine sample. Too much protein in the urine will make the paper change color. Or the doctor may ask for a 24-hour collection of urine for a more precise measurement of the protein and other substances in the urine.
The doctor may take a blood sample to see how well the kidneys are removing wastes. Healthy kidneys remove creatinine and urea nitrogen from the blood. If the blood contains high levels of these waste products, some kidney damage may have already occurred. But most children with nephrotic syndrome do not have permanent kidney damage.

In some cases, the doctor may want to examine a small piece of kidney tissue with a microscope to see if something specific is causing the syndrome. The procedure of collecting a small tissue sample from the kidney is called a biopsy, and it is usually performed with a long needle passed through the skin. The child will be awake during the procedure and receive calming drugs and a local painkiller at the site of the needle entry. A child who is prone to bleeding problems may require open surgery for the biopsy. General anesthesia will be used if surgery is required. For any biopsy procedure, the child will stay overnight in the hospital to rest and allow the health care team to address quickly any problems that might occur.

A strip of chemically treated paper will change color when dipped in urine with too much protein.

What conditions are associated with childhood nephrotic syndrome?

Minimal Change Disease
The condition most commonly associated with childhood nephrotic syndrome is minimal change disease. Doctors do not know what causes it. The condition is called minimal change disease because children with this form of the nephrotic syndrome have normal or nearly normal appearing kidney biopsies. If a child is diagnosed with minimal change disease, the doctor will probably prescribe prednisone, which belongs to a class of drugs called corticosteroids. Prednisone stops the movement of protein from the blood into the urine, but it does have side effects that the doctor will explain. Following the doctor’s directions exactly is essential to protect the child’s health. The doctor may also prescribe another type of drug called a diuretic, which reduces the swelling by helping the child urinate more frequently.

When protein is no longer present in the urine, the doctor will begin to reduce the dosage of prednisone. This process takes several weeks. Some children never get sick again, but most experience a relapse, developing swelling and protein in the urine again, usually following a viral illness. However, as long as the child continues to respond to prednisone and the urine becomes protein free, the child has an excellent long-term outlook without kidney damage.

Children who relapse frequently, or who seem to be dependent on prednisone or have side effects from it, may be given a second type of drug called a cytotoxic agent. The agents most frequently used are cyclophosphamide and chlorambucil. After reducing protein in the urine with prednisone, the doctor may prescribe the cyclophosphamide or chlorambucil for 8 to 12 weeks. Alternatively, cyclosporine,
a drug also used in transplant patients, may be
given. Treatment with cyclosporine frequently
continues over an extended period.

In recent years, doctors have explored the
use of mycophenolate mofetil (MMF) instead
of cytotoxic agents for children who relapse
frequently. MMF is an immunosuppressant
used to treat autoimmune diseases and to keep
the body from rejecting a transplanted organ.
MMF has not been tested for treating minimal
change disease in large clinical trials, but doc-
tors report promising results with small num-
bers of patients. MMF has milder side effects
than cytotoxic agents, but taking immunosup-
pressants can raise the risk of infection and
other diseases. The good news is that most
children outgrow minimal change disease by
their late teens with no permanent damage to
their kidneys.

**Focal Segmental Glomerulosclerosis**
(FSGS) and **Membranoproliferative
Glomerulonephritis (MPGN)**

In about 20 percent of children with nephrotic
syndrome, a kidney biopsy reveals scarring or
deposits in the glomeruli. The two most com-
mon diseases that damage these tiny blood-
filtering units are FSGS and MPGN.

Because prednisone is less effective in treat-
ing these diseases than it is in treating minimal
change disease, the doctor may use additional
therapies, including cytotoxic agents. Recent
experience with another class of drugs called
ACE inhibitors, usually used to treat high
blood pressure, indicates these drugs can help
decrease the amount of protein leaking into
the urine and keep the kidneys from being
damaged in children with FSGS or MPGN.

**Congenital Nephropathy**

Rarely, a child may be born with congenital
nephropathy, a condition that causes nephrotic
syndrome. The most common form of this
condition is congenital nephropathy of the
Finnish type (CNF), inherited as an autosomal
recessive trait—meaning the gene for CNF
must be inherited from both parents.

Another condition that causes nephrotic syn-
drome in the first months of life is diffuse
mesangial sclerosis (DMS). The pattern of
inheritance for DMS is not as clearly under-
stood as the pattern for CNF, although the
condition does appear to be genetic.

Since medicines have little effect on congeni-
tal nephropathy, transplantation is usually
required by the second or third year of life,
when the child has grown enough to receive a
kidney. To keep the child healthy, the doctor
may recommend infusions of the protein albu-
min to make up for the protein lost in urine
and prescribe a diuretic to help eliminate the
extra fluid that causes swelling. The child’s
immune system may be weakened, so antibiotics
should be given at the first sign of infection.

Congenital nephropathy can disturb thyroid
activity, so the child may need the substitute
hormone thyroxine to promote growth and
help bones mature. Some children with con-
genital nephropathy have excessive blood
clotting, or thrombosis, which must be treated
with a blood thinner like warfarin.

A child with congenital nephropathy may need
tube feedings to ensure proper nutrition. In
some cases, the diseased kidneys may need to
be removed to eliminate proteinuria. Dialy-
sis will then be required to replace kidney
function until the child’s body is big enough
to receive a transplanted kidney. Peritoneal
dialysis is preferable to hemodialysis for young
children.
In peritoneal dialysis, a catheter is surgically placed in the abdomen and then used to introduce a solution into the abdominal cavity, or peritoneum. The solution draws wastes and extra fluid from the bloodstream. After a few hours, the solution is drained and replaced with a fresh supply. The drained solution carries the wastes and extra fluid out of the body.

**Points to Remember**

- Nephrotic syndrome is a set of signs or symptoms that may point to kidney problems.
- Childhood nephrotic syndrome is most common between the ages of 1½ and 5 years.
- Nephrotic syndrome causes proteinuria, low levels of protein in the blood, less frequent urination, and swelling and weight gain from the buildup of fluid.
- Diagnosis of nephrotic syndrome requires urine and blood samples and may include a kidney biopsy.
- Most cases of childhood nephrotic syndrome result from minimal change disease.
- The two most common diseases that damage the kidneys’ tiny blood-filtering units and cause nephrotic syndrome are focal segmental glomerulosclerosis (FSGS) and membranoproliferative glomerulonephritis (MPGN).
- Congenital nephropathy is a rare condition that causes nephrotic syndrome in newborns.

**Hope through Research**

The NIDDK conducts and supports research to help people with kidney disease, including children. The NIDDK’s Division of Kidney, Urologic, and Hematologic Diseases (DKUHD) maintains the Pediatric Nephrology Program, which supports research into the causes, treatment, and prevention of kidney disease in children. In 2002, the DKUHD initiated the Focal Segmental Glomerulosclerosis Clinical Trial to learn more about the best way to treat FSGS. Then, in 2003, the DKUHD began the Prospective Study of Chronic Kidney Disease in Children to learn more about the negative effects of pediatric kidney disease, including cardiovascular disease and neurocognitive impairment.

People interested in participating in clinical trials of new treatments for nephrotic syndrome can find a list of centers recruiting patients at [www.ClinicalTrials.gov](http://www.ClinicalTrials.gov).

**For More Information**

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152 Madison Avenue, Suite 201  
New York, NY 10016  
Phone: 1.800.633.6628  
Fax: 212.629.5652  
Internet: [www.kidneyurology.org](http://www.kidneyurology.org)
You may also find additional information about this topic using the following databases:

The NIDDK Reference Collection is a collection of thousands of materials produced for patients and health care professionals, including fact sheets, brochures, and audiovisual materials. Visit www.catalog.niddk.nih.gov/resources.

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