Overview of Kidney Diseases in Children

What are the kidneys, and what do they do?
The kidneys are two bean-shaped organs located near the middle of the back, just below the rib cage. When blood flows through the kidneys, waste products and extra water are removed from the blood and sent to the bladder as urine. The kidneys also regulate blood pressure, balance chemicals like sodium and potassium, and make hormones to help bones grow and keep the blood healthy by making new red blood cells.

Who is at risk?
In the general population, slightly more than 30 people in every 100,000 develop kidney failure each year. In the pediatric population—age 19 and under—the annual rate is only 1 or 2 new cases in every 100,000 children. In other words, adults are about 20 times more likely to develop kidney failure than children. The risk increases steadily with age.

African Americans in their late teens are three times more likely than Caucasians in the same age group to develop kidney failure. Diseases that damage the tiny blood vessels in the kidney are also more common in children of color. Moreover, boys are nearly twice as likely as girls to develop kidney failure from birth defects, polycystic kidney disease, or other hereditary diseases.

What are the causes of kidney failure in children?
Kidney failure may be acute or chronic. Acute diseases develop quickly and can be very serious. Although an acute disease may have long-lasting consequences, it usually lasts for only a short time and then goes away once the underlying cause has been treated. Chronic diseases, however, do not go away and tend to get worse over time. When the kidneys stop working, doctors use a treatment called dialysis to remove waste products and extra water from patients with chronic kidney failure.

Acute Kidney Diseases
Acute kidney disease may result from an injury or from poisoning. Any injury that results in loss of blood may reduce kidney function temporarily, but once the blood supply is replenished, the kidneys usually return to normal. Other kinds of acute kidney disease in children are

- **Hemolytic uremic syndrome.** This rare disease affects mostly children under 10 years of age and can result in kidney failure. Eating foods contaminated by bacteria leads to an infection in the digestive system, which in the first stages causes vomiting and diarrhea. When these symptoms subside, the child is still listless and pale. Poisons produced by the bacteria can damage the kidneys, causing acute kidney failure. Children with hemolytic uremic syndrome may need blood transfusion or dialysis for a short time. Most children,
however, return to normal after a few
weeks. Only a small percentage of children
(mostly those who have severe acute kidney
disease) will develop chronic kidney disease.

**Nephrotic syndrome.** A child with this syn-
drome will urinate less often, so the water
left in the body causes swelling around the
eyes, legs, and belly. The small amount of
urine the body makes contains high levels of
protein. Healthy kidneys keep protein in
the blood, but damaged kidneys let it leak
from the blood into the urine. Nephrotic
syndrome can usually be treated with pred-
nisone to stop protein leakage, and some-
times a diuretic is used to help the child
urinate and reduce the swelling. Usually,
the child can take smaller and smaller doses of
prednisone and eventually return to normal
without lasting kidney damage. This tempo-
rary condition is called minimal change dis-
ease. Relapses are common but usually
respond to prednisone treatment.

**Chronic Kidney Diseases**
Unfortunately, the conditions that lead to chronic
kidney failure in children cannot be easily fixed.
Often, the condition will develop so slowly that it
goes unnoticed until the kidneys have been per-
manently damaged. Treatment may slow down
the progression of some diseases, but in many
cases the child will eventually need dialysis or
transplantation.

**Birth defects.** Some babies are born without
kidneys or with abnormally formed kidneys.
The kidney abnormality is sometimes part of a
syndrome that affects many parts of the body.

**Blocked urine flow and reflux.** If blockage
develops between the kidneys and the opening
where urine leaves the body, the urine can back
up and damage the kidney.

**Hereditary diseases.** In polycystic kidney dis-
ease (PKD), children inherit defective genes
that cause the kidneys to develop many cysts,
sacs of fluid that replace healthy tissue and
keep the kidneys from doing their job. In

Alport syndrome, the defective gene that
causes kidney disease may also cause hearing
or vision loss.

**Glomerular diseases.** Some diseases attack the
individual filtering units in the kidney. When
damaged, these filters—which are called
glomeruli—leak blood and protein into the
urine. If the damage to the glomeruli is severe,
kidney failure may develop.

**Systemic diseases.** Diabetes and lupus can
affect many parts of the body, including the
kidneys in some people. In lupus, the immune
system becomes overactive and attacks the
body’s own tissues. Diabetes leads to high lev-
els of blood glucose that damage the glomeruli.
Diabetes is the leading cause of kidney failure
in adults. In children, however, diabetes is low
on the list of causes because it usually takes
many years of high blood glucose for the kid-
ney disease of diabetes to develop. However,
an increasing number of children have type 2
diabetes, which is usually associated with
adults. As a result, we may see more children
with chronic kidney failure caused by diabetes
in the future.
From birth to age 4 years, birth defects and hereditary diseases are by far the leading causes of kidney failure. Between ages 5 and 14 years, hereditary diseases continue to be the most common causes, followed closely by glomerular diseases. In the 15- to 19-year-old age group, glomerular diseases are the leading cause, and hereditary diseases become rarer.

**What are the treatments for kidney failure?**

A child whose kidneys fail completely must receive treatment to replace the work the kidneys do. The two types of treatment are dialysis and transplantation.

**Dialysis**

Dialysis is a way to remove the waste products and extra water from the blood of patients with kidney failure. The two main types of dialysis are peritoneal dialysis and hemodialysis.

- **Peritoneal dialysis.** This method uses the lining of the child’s abdominal cavity, the peritoneum, as a filter. A catheter placed in the child’s belly is used to pour a solution containing dextrose (a sugar) into the abdominal cavity. While the solution is there, it pulls wastes and extra fluid from the blood. Later, the solution is drained from the belly, along with the wastes and extra fluid. The cavity is then refilled, and the cleaning process continues. Peritoneal dialysis can be performed in the home, usually while the child sleeps, without a health professional present. You and your child will receive extensive training before you start home treatments.

- **Hemodialysis.** This method uses a machine that carries the child’s blood through a tube to a dialyzer, a canister that contains thousands of fibers that filter out the wastes and extra fluid. The cleaned blood is then returned to the child through a different tube. Hemodialysis is usually performed in a clinic under the supervision of a nurse and kidney specialist. It is generally required three times a week for about 3 to 4 hours each time.

**Transplantation**

Transplantation provides the closest thing to a cure for kidney failure. In this procedure, a surgeon places a healthy kidney in the child’s body. The kidney may come either from a living donor or from someone who has just died.

- **Living donor.** Most people can donate a kidney without hurting their health. Many children receive a kidney from one of their parents, but the donor does not have to be a family member.

- **Deceased donor.** If no living donors are available, a child may be placed on a waiting list to receive a kidney from someone who has just died. The United Network for Organ Sharing (UNOS) maintains a computerized system for matching kidneys with appropriate recipients.

People who have transplants must take drugs to keep the body’s immune system from rejecting the new organ. These immunosuppressive drugs can help maintain good function in the transplanted kidney for many years. However, they may have some undesirable side effects such as making a child vulnerable to infections.

For more information about dialysis and transplantation, see the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) fact sheet *Treatment Methods for Kidney Failure in Children*.

**Hope Through Research**

Through its Division of Kidney, Urologic, and Hematologic Diseases, the NIDDK supports several programs and studies devoted to improving treatment for patients with progressive kidney disease and kidney failure. The NIDDK maintains the Pediatric Nephrology Program, which supports research into the causes, treatment, and prevention of kidney diseases in children, including congenital malformations of the urinary tract, polycystic disease, primary glomerular disease, and postinfectious glomerulonephritis.
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The National Kidney and Urologic Diseases Information Clearinghouse (NKUDIC) is a service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The NIDDK is part of the National Institutes of Health under the U.S. Department of Health and Human Services. Established in 1987, the Clearinghouse provides information about diseases of the kidneys and urologic system to people with kidney and urologic disorders and to their families, health care professionals, and the public. The NKUDIC answers inquiries, develops and distributes publications, and works closely with professional and patient organizations and Government agencies to coordinate resources about kidney and urologic diseases.

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