Growth Failure in Children with Kidney Disease

How do the kidneys affect a child’s growth?

In addition to removing wastes and extra fluid from the blood, the kidneys perform several functions important for a child’s growth, including:

- helping regulate the amounts and interactions of nutrients from food, including minerals like calcium, phosphorus, and vitamin D
- maintaining the proper acid-base balance in the blood
- producing the hormone erythropoietin (EPO), which promotes red blood cell production
- playing a possible role in the metabolism of growth hormone, also called somatotropin

Calcium and vitamin D are essential for normal bone growth. The kidneys turn vitamin D into an active hormone called calcitriol that helps bones absorb the right amount of calcium from blood. The kidneys also eliminate excess phosphorus. If the kidneys are impaired, bones do not get enough calcium either because the kidneys fail to turn vitamin D into calcitriol or because they let too much phosphorus build up in the blood. The excess phosphorus draws calcium into the blood and blocks calcium from getting to the bones.

How is growth failure treated?

The child’s doctor may recommend a number of strategies to treat growth failure.

Low-phosphorus Diet

Dietary changes involve limiting foods that are high in phosphorus, like milk and other dairy products. Cream cheese and cottage cheese are acceptable low-phosphorus dairy foods. High-phosphorus foods also include meat, fish, and poultry and some vegetables like broccoli, peas, and beans. Dark breads, like whole wheat and pumpernickel, and many cereals are also high in phosphorus. Because avoiding all of these foods is almost impossible, caregivers must:

Learning the phosphorus content of foods and measuring portions can help control phosphorus intake.
work with a dietitian to find a healthy way to limit phosphorus in the child’s diet while still providing enough calories and other nutrients for growth and health. Learning the phosphorus content of foods and measuring portions can help control phosphorus intake.

**Phosphate Binders**

In addition to limiting phosphorus in the child’s diet, the doctor may recommend a phosphate binder. This medicine binds some of the phosphorus in the bowel so that it is excreted in the child’s stool. Phosphate binders come in the form of chewable tablets, liquids, capsules, and pills. Some children can use over-the-counter antacid tablets as phosphate binders because they contain calcium. A calcium-free binder may be prescribed if calcium buildup in the blood is a concern. The child should take the phosphate binder with meals and only according to the doctor’s recommendations.

**Nutritional Supplements**

Children with advanced kidney disease may lose their appetite or lack the energy to eat. These children may need nutritional supplements to support growth. In some cases, tube feeding is required. While drastic, tube feeding is often the best way to ensure a child gets the full supply of fluid and nutrients needed to promote growth and development. Feeding tubes are most often used in infants, but sometimes older children and adolescents benefit from them as well. See the fact sheet *Nutrition in Children with Chronic Kidney Disease* from the National Kidney and Urologic Diseases Information Clearinghouse (NKUDIC) for more information.

**Calcitriol and Other Vitamin D Medications**

Children with chronic kidney disease may also need to take a synthetic form of calcitriol or a similar vitamin D medication to help the bones absorb calcium and help build bones. These medications also help in the growth process. These supplements may be administered by injection or taken orally in pill form.

**Alkaline Agents**

The doctor may prescribe sodium bicarbonate or some other alkaline agent to restore the acid-base balance in a child with acidosis—high levels of acid in the blood. Acidosis resulting from chronic kidney disease can disrupt growth.

**Erythropoietin (EPO)**

Children with chronic kidney disease may develop anemia. Anemia is the shortage of red blood cells, which deliver oxygen throughout the body. Lack of oxygen can lead to fatigue and poor growth. The kidneys support the production of red blood cells by making the hormone EPO. Kidney disease decreases the production of EPO, causing anemia. The doctor may prescribe a man-made form of EPO given by injection to treat this problem.

**Growth Hormone**

If the child is very short as a result of kidney disease, some doctors prescribe injections of human growth hormone. Almost all pediatric nephrologists believe that the availability of growth hormone has been an important advance in the treatment of small
children with chronic kidney disease. Most studies suggest that growth hormone stimulates growth in children with chronic kidney conditions or children undergoing maintenance dialysis treatment or transplantation.

Points to Remember

- The kidneys play an important role in a child’s growth.
- The kidneys help regulate the amounts and interactions of nutrients from food, including minerals like calcium, phosphorus, and vitamin D, that are necessary for growth.
- If the kidneys are impaired, bones do not get enough calcium either because the kidneys fail to turn vitamin D into calcitriol or because they let too much phosphorus build up in the blood.
- Growth failure is treated with
  - low-phosphorus diet
  - phosphate binders
  - nutritional supplements
  - calcitriol and other vitamin D medications
  - alkaline agents
  - erythropoietin (EPO)
  - growth hormone

Hope through Research

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) conducts and supports research to help people of all ages with kidney disease. The NIDDK’s Division of Kidney, Urologic, and Hematologic Diseases (KUH) maintains the Pediatric Nephrology Program, which supports research into the causes, treatment, and prevention of kidney disease in children. In 2003, the KUH division 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 growth failure. That study is ongoing.

Participants in clinical trials can play a more active role in their own health care, gain access to new research treatments before they are widely available, and help others by contributing to medical research. For information about current studies, visit www.ClinicalTrials.gov.

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You may also find additional information about this topic by
- searching the NIDDK Reference Collection at www.catalog.niddk.nih.gov/resources
- visiting MedlinePlus at www.medlineplus.gov

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