Kidney disease is a major cause of morbidity and mortality in children. Chronic kidney disease recently has been classified into five stages based on the level of glomerular filtration rate.

Chronic kidney disease (CKD) stage 5 (glomerular filtration rate < 15 mL/min/1.73 m²), previously termed end-stage renal disease, affects 9 to 10 per million children annually. Renal diseases resulting in CKD are age dependent. In young children, congenital and hereditary renal disease and urinary tract infection (UTI) account for the majority of causes. Congenital abnormalities of the kidney and urinary tract occur in 5% to 10% of the population; in approximately two-thirds of patients with abnormalities of other organ systems (especially cardiovascular and gastrointestinal); and in 25% of the total ultrasonographically diagnosed malformations in utero.

UTI occurs in 2% of boys and 8% of girls prior to sexual activity and in 7% of febrile infants, making it the second most-frequent bacterial infection in children after respiratory infections. In older children, glomerulonephritis (GN) is the prevalent cause of CKD. Some risk factors for the development of CKD in children include low birth weight, prematurity, obesity, diabetes, and adolescent smoking.

The treatment of choice for CKD stage 4 or 5 is renal transplantation. Chronic peritoneal or hemodialysis can be used as a temporary measure. Chronic dialysis is expensive and is often associated with technical problems. Transplantation is also expensive and is complicated by rejection and, sometimes, recurrence of the original disease in the transplanted kidney. Additionally, the available centers and renal grafts are not adequate to cover all patients requiring this treatment.

The best “treatment” of CKD, therefore, is prevention. Prevention of kidney disease may be achieved by identifying risk factors, early diagnosis, clinical and genetic screening, prenatal diagnosis, and early intervention. Pediatricians should have a high index of suspicion of renal disease because it may present with subtle signs and symptoms. They should also be familiar with its mode of presentation. Renal disease in children may present with signs and symptoms of the disease, abnormal urinalysis, UTI, electrolyte and acid-base abnormalities, decreased renal function, glomerular disease, renal tubular defects, congenital abnormalities of the kidney or urinary tract, hypertension, and renal involvement in systemic diseases.

ROLE OF PEDIATRICIAN

In this era of health care management, pediatricians are expected to recognize, diagnose, and treat some clinical conditions in children that previously would have been referred to the pediatric specialist. They have the difficult task of initiating the diagnosis and treatment of kidney disease in children without over-investigation, and should know when to refer a patient to the pediatric nephrologist. Pediatricians should be able to diagnose and treat many renal conditions, including UTI; acute GN; minimal change nephrotic syndrome; uncomplicated cases of hematuria, proteinuria, and water and electrolyte abnormalities; and any other conditions they believe to be within the scope of their ability to treat.

It is essential that they take an accurate history of disease in the patient and family, perform a thorough physical examination (including blood pressure determination), perform a urinalysis, and request relevant laboratory and imaging studies. Complicated renal problems, CKD, acute kidney injury, renal tubular disease, unexplained acid-base and electrolyte abnormalities, and diseases requiring histological diagnosis and the help of a team of experts should be referred to the pediatric nephrologist.

URINALYSIS INTERPRETATION

In this issue, Bernard S. Kaplan, MBBCh, and Madhura Pradhan, MD, review how to interpret urinalysis (see page 110). A carefully performed urinalysis using physical, chemical, and microscopic examination remains the single most informative test to identify renal disease. Proper collection, identification, preservation, and examination are prerequisites for a reliable test. Although abnormal urinalysis may be the only presenting sign of CKD, the diagnostic yield in children is very low, occurring in 1 of every 800 to 1,000 cases. In 2007, the American Academy of Pediatrics (AAP) made a recommendation to discontinue routine urine screening in children.

PEDIATRIC HYPERTENSION

Pediatric hypertension, historically assumed to be secondary to renal, cardiovascular, and endocrinological disease, is now considered to be a spectrum of essential hypertension mainly linked to the obesity...
epidemic. Obesity is a strong and potentially reversible factor for the development and progression of CKD. Therefore, it is important for the pediatrician to help prevent obesity and detect early hypertension. Dietary intervention, weight management, exercise, stress reduction, and cessation of smoking in adolescents are primarily the pediatrician’s responsibility.

Familial clustering of CKD in adults has been reported by several groups, including families with members having nephropathy associated with type 1 and type 2 diabetes mellitus, hypertension, chronic GN, systemic lupus erythematosus, and HIV infection. Children from such families have to be examined at frequent intervals for proteinuria, microalbuminuria, and renal function. Vesicoureteral reflux, a major cause of renal scarring in children, may be familial in as many as 45% of cases.

MOLECULAR GENETICS

Recent developments in molecular genetics have made it possible to diagnose many genetic conditions affecting the kidney before they are clinically manifest. Current methodology can detect autosomal dominant polycystic kidney disease, Wilms’ tumor, Alport syndrome, steroid-resistant nephrotic syndrome, and many other conditions.

A gene mutation should be suspected if another family member is affected, if there are other malformations, or if the clinical course is atypical. Prenatal diagnosis of many renal conditions is now possible. This also opens the door to early treatment and gene therapy. Pediatricians should keep in mind the limitations and complex ethical issues associated with genetic testing.

The relentless progression of CKD is postulated to result from a self-perpetuating vicious cycle of fibrosis activated after initial injury, due to a variety of factors. Once children with CKD are identified, the pediatrician should refer them to a pediatric nephrologist. It is not well known whether treatment of glomerulopathies can prevent progression of the disease to CKD, because these diseases may represent similar end-organ responses to different pathological processes. There is some evidence, however, that early treatment of some of these conditions, such as membranoproliferative disease and rapidly progressive glomerulonephritis, may prevent or delay progression to renal failure. Limiting protein intake, restricting sodium and phosphate in the diet, controlling hypertension, and use of vitamin D and other experimental modalities may be helpful.

KIDNEY DISEASE PREVENTION

Other ways to prevent renal disease in children include establishing kidney disease prevention programs and mass screening of school children. Although well established in Japan, Taiwan, and Korea, there appears to be movement away from mass screening to detect CKD in children and adolescents in North America and Europe. A more complete knowledge of the etiology, pathogenesis, molecular genetics of renal dysgenesis, and treatment of renal disease is needed before more effective prevention is achieved.

Finally, pediatricians should stay current on the pediatric literature as the science is continuously evolving. Although performing renal ultrasound and voiding cystourethrogram on children with UTI was once a routine practice, the AAP and the National Institute for Health and Clinical Excellence (NICE) are now recommending a marked reduction in the imaging that children younger than 3 years with UTI should undergo. Both the AAP and NICE now agree that prophylactic antibiotic treatment should not be routinely used in these children, including those with major vesico-ureteral reflux. The latest guidelines for the management of UTI are discussed by Kjell Tullus, MD, PhD, FRCPCH (see page 111).

Prevention of renal disease is crucial and may be achieved by early recognition, diagnosis, and treatment to prevent morbidity and progression of CKD. Educating the general public regarding risk factors for renal disease, including obesity and adolescent smoking, is vital. The pediatrician has a major role to play in this process.

About the Guest Editor

Amin J. Barakat, MD, FAAP, is Clinical Professor of Pediatrics, Georgetown University Medical Center; and Clinical Professor of Pediatrics, The George Washington University School of Medicine and Health Sciences. He received his medical degree from the American University of Beirut, Lebanon. Dr. Barakat completed residencies in pediatrics at the American University of Beirut Medical Center and Johns Hopkins Hospital, followed by a fellowship in pediatric nephrology at Georgetown University Medical Center, including training in renal pathology at the Armed Forces Institute of Pathology. He has been certified by the American Board of Pediatrics since 1972.

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