

CHAPTER

52

The Child with Alterations in Genitourinary Function



Planning Terrell's day can be a challenge, because his treatment often interferes with his activities. We all hope that Terrell receives a kidney transplant soon so his growth will improve and he will not have to miss school during treatment.

—Aunt of Terrell

LEARNING OBJECTIVES

- Describe the pathophysiologic processes associated with genitourinary disorders in the pediatric population.
- Discuss the nursing management of a child with a structural defect of the genitourinary system.
- Develop a nursing care plan for the child with a urinary tract infection.
- Describe the growth and developmental issues for the child with chronic renal failure.
- Outline a plan to meet the fluid and dietary restrictions of a child with a renal disorder.
- Develop a nursing care plan for the child with acute and chronic renal failure on dialysis.
- List psychosocial issues for children of different ages who have surgery on the genitourinary system.

MEDIA LINK



www.prenhall.com/london

CD-ROM

Animations/Videos:

Circumcision
Renal Function
Furosemide (Drug Animation)
Sexually Transmitted Infections

Skill 16-1: Performing a Urinary Catheterization

NCLEX-RN® Review

Audio Glossary

Companion Website

NCLEX-RN® Review

Thinking Critically

Case Study

Audio Glossary

MediaLink Applications:

Care Plan: A School-Age Child with Enuresis

Case Study: A Child with Chronic Kidney Failure

Care Plan: A Child with Kidney Failure

Care Plan: A Child with Nephrotic Syndrome

Many infections, structural disorders, and disease processes alter genitourinary function. Because the kidneys and other urinary system organs perform several essential body functions, including removing waste products and maintaining fluid and electrolyte balance, disorders that affect these organs pose a significant threat to the health of children.

Although the reproductive system is functionally immature until puberty, uncorrected structural defects and sexually transmitted diseases can have both psychologic and physiologic implications for the developing child.

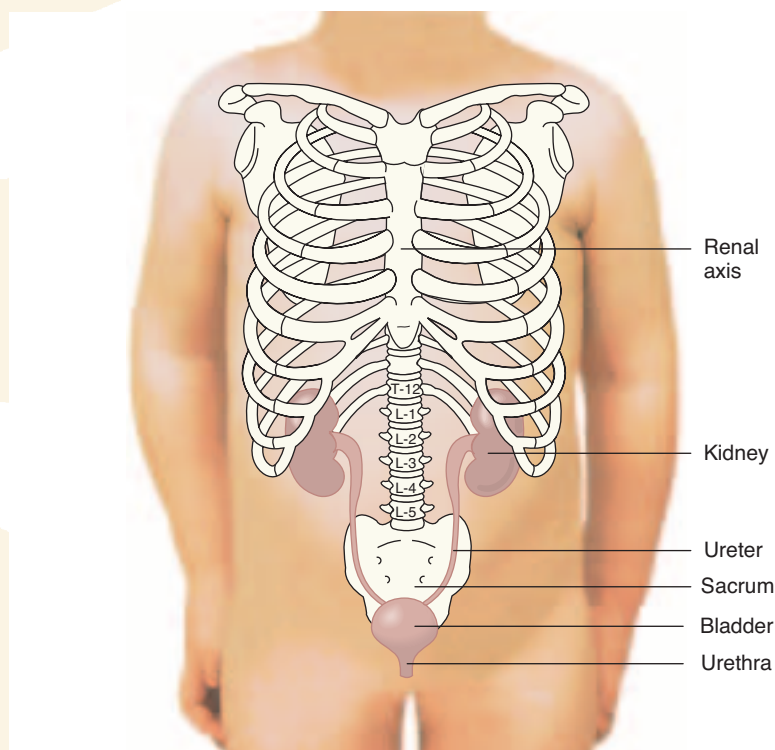
ANATOMY AND PHYSIOLOGY OF PEDIATRIC DIFFERENCES

The genitourinary system is made up of the urinary and reproductive organs. The urinary system—kidneys, ureters, bladder, and urethra (Figure 52-1 ●)—excretes wastes and maintains acid-base and fluid and electrolyte balance. The reproductive system consists of internal and external organs that at maturity promote the conception and healthy development of a fetus.

URINARY SYSTEM

All of the nephrons that will make up the mature kidney are present at birth. The kidneys grow and the tubular system matures gradually during childhood, reaching full size by adolescence. Most renal growth occurs during the first 5 years of life. This increase in size is due primarily to enlargement of the nephrons. The efficiency of the kidney also increases with age. During the first 2 years of life, the kidneys are less efficient at regulating electrolyte and acid-base balance (see Chapter 43 ∞) and eliminating some drugs from the body.

● **FIGURE 52-1**



The kidneys are located between the twelfth thoracic (T12) and third lumbar (L3) vertebrae.

KEY TERMS

Azotemia, 1643
 Chvostek sign, 1645
 Dialysate, 1653
 End-stage renal disease (ESRD), 1649
 Enuresis, 1637
 Hydronephrosis, 1632
 Incarceration, 1663
 Neurogenic bladder, 1635
 Oliguria, 1643
 Osteodystrophy, 1646
 Pyeloplasty, 1633
 Renal insufficiency, 1648
 Stent, 1632
 Uremia, 1643
 Vesicoureteral reflux, 1635

MEDIA LINK



Video: Sexually Transmitted Infections

After the age of 2 years, the kidneys' efficiency increases markedly.

Bladder capacity increases with age from 20 to 50 mL at birth to 700 mL in adulthood. A child's bladder capacity (in ounces) can be estimated by adding 2 to the child's age (e.g., a 4-year-old has a bladder capacity of 6 ounces). Stimulation of "stretch receptors" within the bladder wall initiates urination. Simultaneous contraction of the detrusor muscle of the bladder and relaxation of the internal and external sphincters result in emptying of the bladder. Children less than 2 years of age cannot maintain bladder control because of insufficient nerve development.

GROWTH AND DEVELOPMENT

Urinary output per kilogram of body weight decreases as the child ages because the kidney becomes more efficient at concentrating urine. Expected output is as follows:

Infants	2 mL/kg/hr
Children	0.5 to 1 mL/kg/hr
Adolescents	40 to 80 mL/hr

Normal renal function requires the following: unimpaird renal blood flow, adequate glomerular ultrafiltration, normal tubular function, and unobstructed urine flow.

REPRODUCTIVE SYSTEM

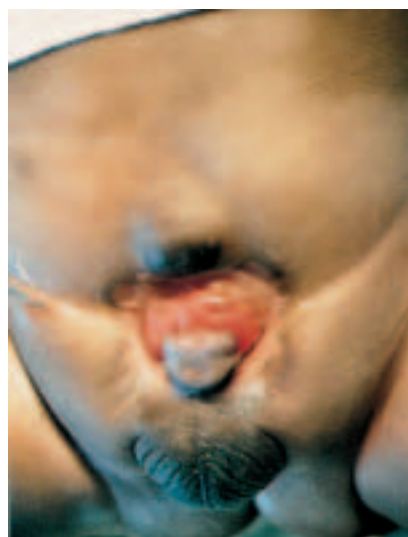
The reproductive system in children is functionally immature until puberty. Throughout childhood the genitalia (with the exception of the clitoris in girls) enlarge gradually. The hormonal changes of puberty accelerate anatomic and functional development (see Chapter 35 for figures illustrating pubertal development ∞). In girls, the mons pubis becomes more prominent and hair begins to grow. The vagina lengthens, and the epithelial layers thicken. The uterus and ovaries enlarge, and the musculature and vascularization of the uterus also increase. In boys, downy hair begins to appear at the base of the penis, and the scrotum becomes increasingly pendulous. The penis grows longer and wider.

STRUCTURAL DEFECTS OF THE URINARY SYSTEM

BLADDER EXSTROPHY

Bladder exstrophy is a rare defect in which the posterior bladder wall extrudes through the lower abdominal wall (Figure 52-2 ●). Failure of the abdominal wall to close during fetal development results in eversion and protuberance of the bladder wall and a wide separation of the rec-

● FIGURE 52-2



This child has bladder exstrophy, noted by extrusion of the posterior bladder wall through the lower abdominal wall.

tus muscles and the symphysis pubis. The upper urinary tract is usually normal. The defect occurs in approximately 1 in every 400,000 live births and is more common in boys than girls (Sponseller, Jani, Jeffs et al., 2001). The bladder mucosa appears as a mass of bright-red tissue, and urine continually leaks from an open urethra. Females have a bifid (split) clitoris. Males have a short, stubby penis, and the glans is flattened with dorsal chordee and a ventral prepuce. Epispadias (see page 1631) and bilateral inguinal hernias are also common.

Surgical reconstruction is performed in several stages. Primary closure of the bladder and abdominal wall is usually completed within 24 to 48 hours after birth. The wound and pelvis are immobilized to promote healing. An osteotomy (see Chapter 55 ∞) to rotate the innominate bones of the pelvis to approximate the symphysis pubis reduces tension on the closed bladder and abdominal wall. Epispadias repair is often performed at age 1 to 2 years or at the same time as the continence surgical procedure. Surgery to reconstruct the bladder neck and reimplant the ureters is performed when the bladder has achieved adequate capacity. The goals of surgical reconstruction are (1) bladder and abdominal wall closure; (2) urinary continence, with preservation of renal function; (3) creation of functional and normal-appearing genitalia; and (4) improvement of sexual functioning. Some children require permanent urinary diversion because a functional bladder cannot be reconstructed.

Because the bladder epithelium is abnormal, it is prone to neoplasms. Periodic examination and cystoscopy after the age of 20 years is recommended to detect malignancies.



NURSING MANAGEMENT

Preoperative nursing care centers on preventing infection and trauma to the exposed bladder. The bladder mucosa is covered in sterile plastic wrap to prevent trauma and irritation, and the surrounding area is cleaned daily and protected from leaking urine with a skin sealant.

Postoperatively the wound and pelvis are immobilized to facilitate healing. Internal and external immobilization techniques are used for pelvic closure (see Chapter 55 ∞). Avoid abduction of the infant's legs. Nursing care includes maintaining proper alignment, monitoring peripheral circulation, and providing meticulous wound and skin care.

Monitor renal function by assessing the adequacy of urine output and blood and urine chemistries to detect signs of renal damage. Observe for any signs of obstruction in the drainage tubes such as increased intensity of bladder spasms, decreased urine output, or urine or blood draining from the urethral meatus. Promote comfort and give antibiotics as ordered.

Parents need emotional support to help them cope with the disfiguring nature of the infant's defect and the uncertainty of complete repair. To promote parent–infant bonding, encourage parents to participate in all aspects of the infant's care, including bathing, feeding, and wound care. Discharge teaching should include instructions about dressing changes and diapering and the need to immediately report any signs of infection or change in renal function. Emphasize the need for routine follow-up visits after surgery to assess urinary function and to ensure that the next stages of surgery for continence control are performed at the appropriate time in the child's development. However, these children do not always achieve continence. Parents need help to promote the child's self-esteem and self-confidence with sexual identity and func-

tion. Psychologic counseling may help the child during adolescence.

HYPOSPADIAS AND EPISPADIAS

Hypospadias and epispadias are congenital anomalies involving the abnormal location of the urethral meatus in males (Figure 52–3 ●). Both defects result when the urethral folds fail to fuse completely over the urethral groove. The reported incidence of hypospadias is 1 in every 125 live male births (Stokowski, 2004).

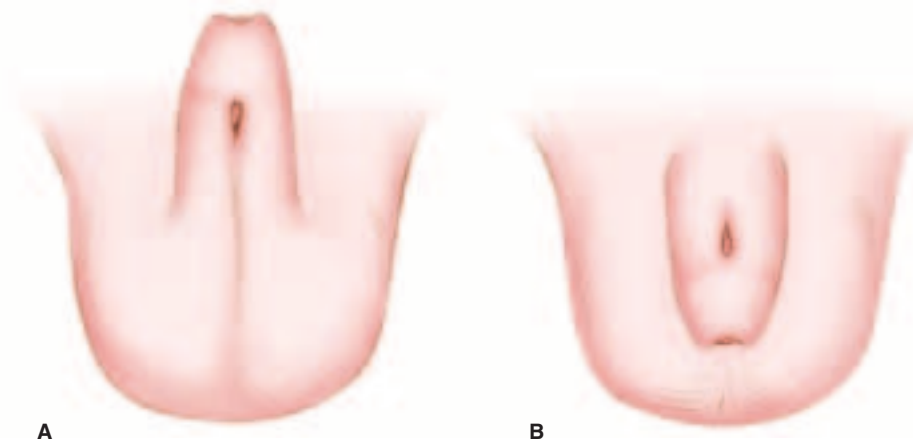
With hypospadias, the urethral meatus can be located anywhere along the course of the anterior urethra on the ventral surface of the penile shaft, from the perineum to the tip of the glans. Most cases are mild, with the meatus slightly off center from the tip of the penis; in severe cases, the meatus is located on the scrotum. Hypospadias often occurs in conjunction with congenital *chordee*, a fibrous line of tissue that results in ventral curvature of the penile shaft.

In epispadias, the meatal opening is located on the dorsal surface of the penile shaft. Epispadias often occurs in conjunction with exstrophy of the bladder.

Diagnosis is made by prenatal ultrasound or by examination at birth. The infant should not be circumcised because the dorsal foreskin tissue may be used for surgical repair. The defects are corrected surgically, usually during the first year of life, to minimize psychologic effects when the child is older. Surgery is usually performed in a single operation, often as an outpatient procedure. The goals of surgical repair are (1) placement of the urethral meatus at the end of the glans penis with satisfactory caliber and configuration for a urinary stream (enabling the child to void in a standing position) and (2) release of *chordee* to straighten the penis (enabling future sexual function).

● FIGURE 52-3

Hypospadias and epispadias. **A**, In hypospadias the urethral canal is open on the ventral surface of the penis. **B**, In epispadias the canal is open on the dorsal surface.



A caudal nerve block is often used for postoperative pain relief. Anticholinergic medications may be prescribed to relieve bladder spasms.

NURSING MANAGEMENT

It is important to address parents' concerns at the time of birth. Preoperative teaching can relieve some of their anxiety about the future appearance and functioning of the penis.

Postoperative care focuses on protecting the surgical site from injury. The infant or child returns from surgery with the penis wrapped in a simple dressing, and sometimes a urethral **stent** (a device used to maintain patency of the urethral canal) is placed to keep the new urethral canal open. Plan care to ensure that the stent does not get removed. Refer to the hospital's policy for the appropriate use of physical restraints in this situation.

Encourage fluid intake to maintain adequate urinary output and patency of the stent. Hourly documentation of intake and output is essential. Notify the physician if there is no urine drainage for 1 hour as this may indicate obstruction. Pain may be associated with bladder spasms. Anticholinergic medications such as oxybutynin or hyoscyamine may be prescribed. Acetaminophen may also be given for pain. Antibiotics are often prescribed until the urinary stent falls out.

Patients are often discharged the day of surgery. Discharge teaching should include instructions for parents about care of the reconstructed area, double-diapering to protect the stent, fluid intake, medication administration, and signs and symptoms of infection (see "Teaching Highlights: Caring for the Child after Hypospadias and Epispadias Repair" and Skill 16-2 in the *Clinical Skills Manual*).

SKILLS Tell parents when the child needs to see the physician for dressing removal.

OBSTRUCTIVE UROPATHY

Obstructive uropathy refers to structural or functional abnormalities of the urinary system that interfere with urine flow. The pressure caused by urine backup compromises kidney function and often causes **hydronephrosis** (accumulation of urine in the renal pelvis as a result of obstructed outflow). Physiologic changes that may occur as a result of hydronephrosis include the following:

- Cessation of glomerular filtration when the pressure in the kidney pelvis equals the filtration pressure in the glomerular capillaries. To compensate, the blood pressure increases to increase the glomerular filtration pressure, but increasing pressure on the glomeruli leads to cell death.
- Metabolic acidosis results when the distal nephrons' ability to secrete hydrogen ions is impaired.

TEACHING HIGHLIGHTS

CARING FOR THE CHILD AFTER HYOSPADIAS AND EPISPADIAS REPAIR

- Use double-diapering to protect the stent (the small tube that drains the urine). See Skill 16-2. **SKILLS**
- Restrict the infant or toddler from activities (e.g., playing on riding toys) that put pressure on the surgical site. Avoid holding the infant or child straddled on the hip. Limit the child's activity for 2 weeks.
- Encourage the infant or toddler to drink fluids to ensure adequate hydration. Provide fluids in a pleasant environment or using a special cup. Offer fruit juice, fruit-flavored ice pops, fruit-flavored juices, flavored ice cubes, and gelatin.
- Be sure to give the complete course of prescribed antibiotics to avoid infection.
- Watch for signs of infection: fever, swelling, redness, pain, strong-smelling urine, or change in flow of the urinary stream.
- The urine will be blood tinged for several days. Call the physician if urine is seen leaking from any area other than the penis.



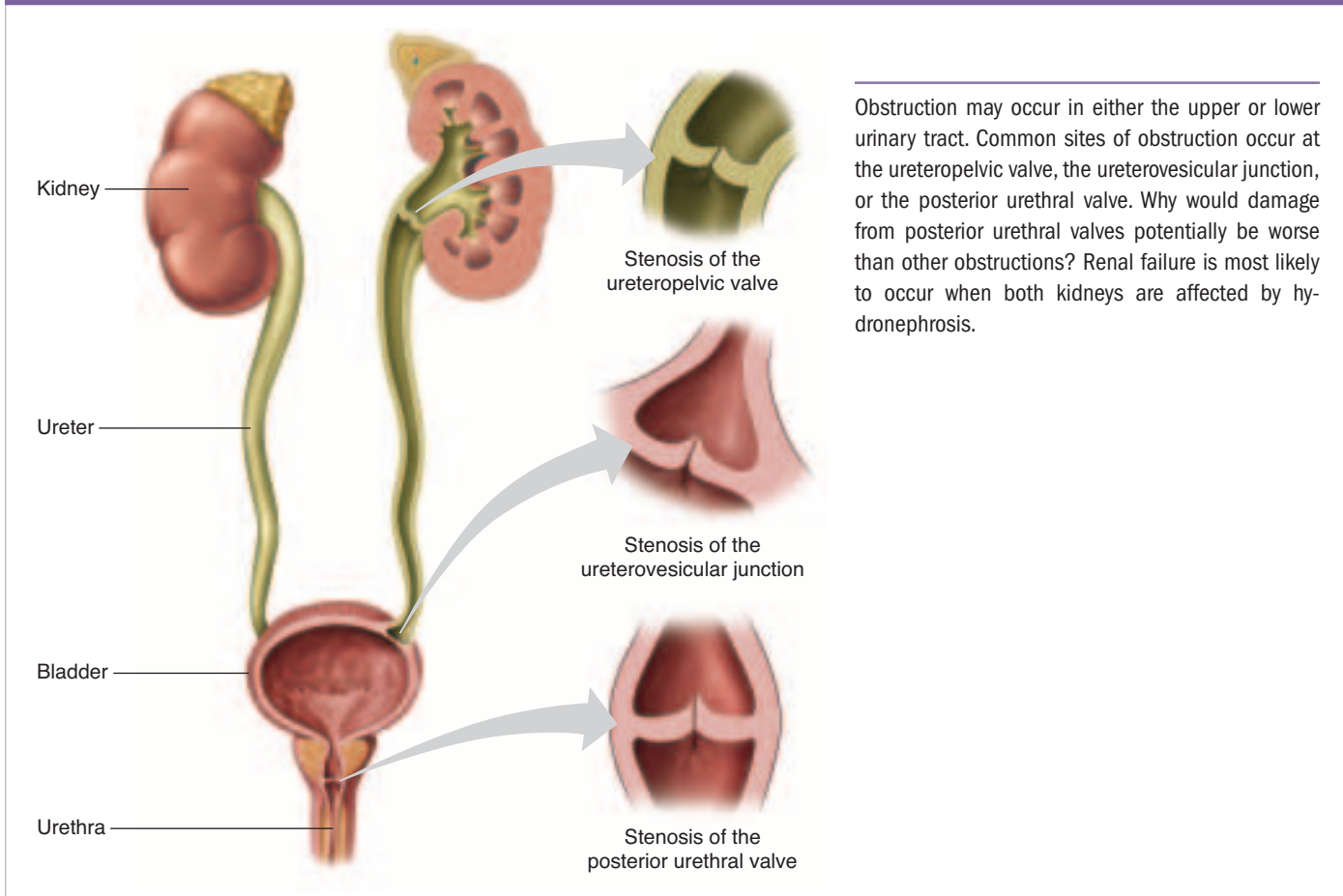
A double-diapering technique protects the urinary stent after surgery for hypospadias or epispadias repair. The inner diaper collects stool; the outer diaper, urine.

- Impairment of the kidney's ability to concentrate urine results in polydipsia and polyuria.
- Obstruction results in urinary stasis, promoting bacterial growth.
- Restriction of urinary outflow causes progressive renal damage and chronic renal failure if untreated.

Obstructive uropathy may be caused by several congenital lesions such as ureteropelvic junction (UPJ) obstruction, posterior urethral valves (PUVs), and stenosis of hypoplasia of the ureterovesicular junction (see "Pathophysiology Illustrated: Obstruction Sites in the Urinary System"). The UPJ is the most common site of obstruction of the upper urinary tract in infants and children. PUVs

PATHOPHYSIOLOGY ILLUSTRATED

Obstruction Sites in the Urinary System



Obstruction may occur in either the upper or lower urinary tract. Common sites of obstruction occur at the ureteropelvic valve, the ureterovesicular junction, or the posterior urethral valve. Why would damage from posterior urethral valves potentially be worse than other obstructions? Renal failure is most likely to occur when both kidneys are affected by hydronephrosis.

(abnormal folds of mucous in the male urethra) are the most common cause of anatomic bladder outlet obstruction, occurring in approximately 1 in 5000 to 8000 live male births (Vogt, 2002).

Prune-belly syndrome, also known as Eagle-Barrett syndrome, is another cause of hydronephrosis. In this congenital defect, the abdominal musculature fails to develop. The skin covering the abdominal wall is thin and resembles a wrinkled prune. Other characteristics include urinary tract anomalies, poor ureteral peristalsis, enlarged bladder, high risk for recurrent urinary tract infection, and bilateral cryptorchidism. Prune-belly syndrome occurs predominantly in males (95%), with an incidence of 1 in 35,000 to 50,000 births (Vogt, 2002).

Other conditions that can lead to hydronephrosis include myelomeningocele and neoplasms. Clinical manifestations vary, depending on the cause and location of the obstruction (see “Clinical Manifestations: Obstructive Lesions of the Urinary System”).

Early diagnosis and treatment prevent kidney damage and deterioration of renal function. Prenatal ultrasound

may detect hydronephrosis and PUV. A diuretic enhanced radionuclide scan and voiding cytourethrogram are performed when UPJ or ureterovesicular obstruction is suspected. Table 52–1 lists diagnostic tests commonly used to identify urinary tract conditions.

The goals of surgical correction or diversion are to lower the pressure within the collecting system, which reduces renal damage, and to prevent stasis, which decreases the risk of infection. Surgical correction may necessitate **pyeloplasty** (removal of an obstructed segment of the ureter and reimplantation into the renal pelvis) or valve repair or reconstruction, depending on the cause of the obstruction. Urinary incontinence resulting from sphincter weakness is a common problem after surgery.

NURSING MANAGEMENT

Preoperative nursing care focuses on preparing the parents and child for the procedure and addressing parents’ concerns about the postsurgical outcome. Give parents a

TABLE 52-1 ✿ **Diagnostic Tests for Urinary System Conditions**

Test	Use	Nursing Considerations
Urinalysis (see Skills 10-7-10-12) SKILLS	Detects specific gravity, presence of glucose, ketones, protein, blood cells, casts, crystals, and microorganisms.	Use a urine collection bag for infants and children who are not toilet trained. (See Skill 10-7.) Give fluids if unable to void.
Urine culture	Detects the presence of an infection in the urinary system.	Explain the process for cleaning the perineum and collecting the urine midstream in a sterile cup. Clean the perineum and collect a catheter specimen midstream in a sterile container. (See Skill 10-10.)
Voiding cystourethrogram or radionuclide cystography	Shows bladder structure and function, urethral anatomy, bladder masses. Detects vesicoureteral reflux.	Explain catheterization to child and that the bladder will be filled. (See Skill 16-1.) Provide coaching strategies for parents accompanying the child to help the child cope. Assess for allergies as contrast media is used.
Renal or bladder ultrasound	Identifies large renal scars, renal anomalies, obstruction, abscesses, masses, and hydronephrosis.	Noninvasive procedure. Fluids are administered as prescribed.
Intravenous pyelogram (intravenous urography)	Shows the kidney's collecting system, distal ureters, and bladder.	Assess for allergies as contrast medium is used. Infants and children are NPO prior to the study. An IV is started for injection of contrast.
Diuretic renogram	Helps distinguish between obstructive and nonobstructive lesions.	Hydrate the child before the exam. An IV is started and diuretic is infused. The child is catheterized to drain urine during the procedure.
Radionucleotide renal scan with ^{99m} Tc dimercapto-succinic acid (DMSA)	Detects renal parenchymal lesions, renal atrophy, or scars. Differentiates between hydronephrosis caused by obstructive lesions, reflux, or a cyst.	Explain catheterization to child.
Renal biopsy	Determines presence and extent of renal involvement in specific disorders.	NPO 6 hours (or as prescribed) before biopsy. Prepare site and administer preprocedural sedation as prescribed. May require bowel evacuation before test.
Cystoscopy	Shows interior urethra and bladder.	Infants and children are NPO prior to the study. Sedation is administered. Children with cardiac anomalies need antibiotic prophylaxis. Fluids are forced after the procedure to detect problems with voiding.
CT (computed tomography)	Provides detailed visualization of structures of the urinary tract and major renal blood vessels.	Infant or child may be NPO and require bowel evacuation prior to study. Prepare child for size of equipment. Assess for allergies if contrast medium is used. Sedation may be needed.
MRI (magnetic resonance imaging)	Provides detailed visualization of structures of the urinary system.	Prepare child for sounds, size of equipment, and tunnel. Ensure that the child has no metallic implants. Sedation may be needed.

Data from Kraus, S. J. (2001). Genitourinary imaging in children. *Pediatric Clinics of North America*, 48(6), 1381-1423; Hanson, K.A. (2003). Diagnostic tests and tools in the evaluation of urologic disease, Part II. *Urologic Nursing*, 23(6), 405-415.

CLINICAL MANIFESTATIONS	
OBSTRUCTIVE LESIONS OF THE URINARY SYSTEM	
OBSTRUCTIVE LESION	CLINICAL MANIFESTATIONS
Ureteropelvic junction obstruction	In infants: abdominal mass (enlarged kidney), hypertension, urinary tract infection In children: hematuria, pain, intermittent nausea and vomiting
Posterior urethral valves	In infants: abdominal mass (enlarged kidney), distended bladder, poor urinary stream, urinary tract infection, sepsis, low specific gravity, polyuria, increased creatinine level, failure to thrive In children: urinary frequency and incontinence
Ureterovesicular junction obstruction	Urinary tract infection (recurrent or chronic), hematuria, pain, abdominal mass (enlarged kidney), enuresis

chance to discuss concerns about how the disorder will affect the child's long-term renal functioning.

Postoperative care involves monitoring vital signs and intake and output and observing for signs of urine retention, such as decreased output and bladder distention. Many children are discharged with stents or catheters. Teach parents how to change dressings, double-diaper, care for catheters, assess pain and give analgesics, and recognize signs of possible obstruction or infection. Parents should encourage the child to participate in age-appropriate activities. However, children should avoid contact sports because of their potential to injure the bladder.

URINARY TRACT INFECTION

A urinary tract infection (UTI) may be bacterial, viral, or fungal; it occurs in the urinary tract. Cystitis is a lower UTI that involves the urethra or bladder. Pyelonephritis is an upper UTI that involves the ureters, renal pelvis, and renal parenchyma. UTIs can be acute or chronic (the latter either recurrent or persistent).

UTIs are the second most common infections in children. What accounts for the high incidence of these infec-

tions? Among newborns and young infants, most infections occur in boys. They are usually associated with structural defects having a higher incidence in males (e.g., obstructive uropathy), which predispose the infant to infection. Among older infants and children, the incidence of UTIs is higher in girls. This is attributed to the shorter female urethra (2 cm [1 in.] in young girls) and its proximity to the anus and vagina, which increases the risk of contamination by fecal bacteria. An estimated 3% of females and 1% of males will have a UTI by age 11 years (National Kidney and Urological Diseases Information Clearinghouse, 2003).

ETIOLOGY AND PATHOPHYSIOLOGY

Many first UTIs are caused by *Escherichia coli*, a common gram-negative enteric bacterium. Other causative organisms include *Staphylococcus*, *Klebsiella*, *Proteus*, *Pseudomonas*, *Enterobacter*, and *Enterococcus*.

Urinary stasis enhances the risk of UTI. Stasis may be caused by abnormal anatomic structures or abnormal function (e.g., **neurogenic bladder** [interrupted nerve supply to the bladder leading to urinary tract obstruction, for example, from meningomyelocele or spinal cord trauma], common in children with myelomeningocele). Children normally void five to six times a day. Infrequent voiding, common in school-age children, results in incomplete emptying of the bladder and urinary stasis. Other factors associated with increased risk of UTI include an irritated perineum, constipation, masturbation, sexual abuse, and sexually active adolescent females.

Another cause of UTI is **vesicoureteral reflux**, the backflow of urine from the bladder into the ureters during voiding. This prevents complete emptying of the bladder and creates a reservoir for bacterial growth. Vesicoureteral reflux can also result from a structural anomaly in which the ureters insert in an abnormal position into the bladder.

Renal scarring can result from hydronephrosis or pyelonephritis due to the inflammatory and ischemic effects of the infection. Scars have been associated with hypertension, proteinuria, and kidney failure. The risk of kidney damage increases in the following instances:

- UTI in infant less than 1 year of age
- Delay in diagnosis and effective antibacterial treatment for an upper UTI
- Anatomic obstruction or nerve supply interruption
- Recurrent episodes of upper UTIs

CLINICAL MANIFESTATIONS

Symptoms depend not only on the location of the infection, but also on the age of the child. Symptoms in the newborn period tend to be nonspecific—unexplained fever,

failure to thrive, poor feeding, vomiting and diarrhea, strong-smelling urine, and irritability. Any child under 2 years of age with a fever of unknown origin should be tested for a UTI. Not until the toddler years are the more “classic” symptoms of lower UTI seen as listed in the clinical manifestations table. About 40% of UTIs are asymptomatic.

CLINICAL THERAPY

A urine specimen is examined for the presence of bacteria. A dipstick leukocyte esterase test identifies white blood cells and pyuria. A nitrite dipstick detects bacteria. Using both dipsticks increases the sensitivity (88%) and specificity (93%) for diagnosing a UTI (Shaw & Gorelick, 1999). Diagnosis is confirmed with a urine culture collected by midstream clean-catch void, sterile catheterization, or suprapubic aspiration (see Skills 10–7 and 10–8). **SKILLS** Urine collection bags used on infants are reliable only when no pathogens are found as sterility of the specimen cannot be guaranteed. The diagnosis of infection is made from the number of colony-forming units (between 1000 and 100,000) depending upon the method of urine collection (Shaw & Gorelick, 1999). When the specimen is collected by sterile procedure, fewer organisms are needed to confirm infection. Antibiotic sensitivity for the specific organisms cultured is then determined.

Radiologic studies may be performed to detect structural abnormalities and renal scarring. A renal and bladder ultrasound is commonly performed soon after the diagnosis, and a voiding cystourethrogram (VCUG) is obtained to test for vesicoureteral reflux (Mahant, To, & Friedman, 2001). Renal and bladder sonography and a cystogram (either VCUG or radionuclide) are used to detect pyelonephritis and renal scarring (Kraus, 2001).

Antibiotic therapy is begun as soon as urine samples have been collected. The antibiotic is changed if necessary after culture sensitivity is determined. Follow-up cultures should be obtained 48 to 72 hours after drug therapy has

started, at which time the urine should be sterile. Follow-up urine cultures should then be obtained monthly for 3 months, every 3 months for 6 months, and then annually. Subsequent infections may be asymptomatic. For children with vesicoureteral reflux or recurrent infections, a long-term, suppressive dose of an antibiotic may be ordered for prophylaxis, but there is limited evidence that this is effective (Williams, Lee, & Craig, 2001). Children with renal scarring should have their blood pressure monitored.

Children who appear ill and cannot tolerate oral antibiotics are often hospitalized because they need rehydration and parenteral antibiotic treatment. Infants may develop permanent kidney damage or generalized sepsis if the UTI is not treated aggressively. If a structural defect is identified, surgical correction may be necessary to prevent recurrent infections that could lead to renal damage.

NURSING MANAGEMENT

NURSING ASSESSMENT AND DIAGNOSIS

Physiologic Assessment

Take a history of urinary symptoms. Assess the infant for toxic (very ill) appearance, fever, and oral fluid intake. Measure the child’s height and weight and plot on a growth curve to identify any change in growth pattern associated with a chronic illness. Take the infant’s or child’s blood pressure. Palpate the abdomen and suprapubic and costovertebral areas for masses, tenderness, and distention. Observe the urinary stream if possible and perform a urinalysis, including specific gravity. Proper collection of the urine specimen is essential. Get a clean-catch urine specimen if the child is able to cooperate. If not, get a catheterized sample (see Skills 10–7 and 10–8). **SKILLS** An early morning urine specimen is preferred because the urine is more concentrated.

CLINICAL MANIFESTATIONS

URINARY TRACT INFECTION CLINICAL MANIFESTATIONS AND THERAPY

TYPE OF UTI	CLINICAL MANIFESTATIONS	CLINICAL THERAPY
Lower UTI—cystitis	Frequency, dysuria, urgency, enuresis, strong-smelling urine, cloudy urine, hematuria, abdominal pain, fever	5- to 7-day course of trimethoprim or sulfamethoxazole or antibiotic matching organism sensitivity, encourage oral fluids, use an analgesic such as acetaminophen or pyridium
Upper UTI—pyelonephritis	High fever, chills, abdominal pain, flank pain, costovertebral angle tenderness, persistent vomiting, moderate to severe dehydration	Rehydration, antipyretics, IV antibiotics initially then transitioned to oral antibiotics matching organism sensitivity for a total of 7 to 10 days



Psychosocial Assessment

Sexually active adolescents may deny having symptoms because they fear disclosing their sexual activity to their parents. Careful questioning may be necessary to elicit these concerns. Be open and approachable and give the patient and family the chance to address their concerns.

Common nursing diagnoses for the child with a UTI include the following:

- *Impaired Urinary Elimination* related to recurrent urinary tract infections
- *Risk for Disproportionate Growth* related to chronic infection and renal damage
- *Urinary Retention* related to infrequent voiding habits or vesicoureteral reflux
- *Ineffective Therapeutic Regimen Management* related to lack of knowledge of preventive measures (adequate fluid intake, proper hygiene, signs, and prophylactic antibiotics)
- *Risk for deficient fluid volume* related to fever and inadequate intake

PLANNING AND IMPLEMENTATION

Nursing care for the hospitalized child with a complicated UTI centers on administering prescribed medications, promoting rehydration, assessing renal function, and teaching parents and older children how to minimize the risk of future infection.

Administer antibiotics and antipyretics as prescribed to maintain therapeutic drug levels and reduce fever. Encourage fluid intake to dilute the urine and flush the bladder. Frequent voiding minimizes urinary stasis. Document intake and output. Assess renal function by comparing the child's output to the expected measure of 1 mL/kg/hr and weigh the child daily.

Because bladder training is such an important milestone for young children, any disorder that affects voiding may have developmental implications. A toddler who has been toilet trained may regress and require diapers temporarily due to incontinence related to the UTI. An older child may develop enuresis after a prolonged period of being dry at night. A preschooler may perceive the infection as punishment for an imagined wrong such as masturbation. Reassure parents that this is normal and emphasize that they should offer the child support rather than disapproval.

Nursing Care in the Community

Children with UTIs are usually cared for at home. Teach parents that antibiotics must be taken for the full course and that they may be continued even after the infection has cleared to prevent a recurrence. Teach prevention through proper hygiene and avoidance of risk behaviors.

TEACHING HIGHLIGHTS

PREVENTION OF URINARY TRACT INFECTIONS

- Teach proper perineal hygiene. Girls should always wipe the perineum from front to back after voiding.
- Encourage the child to drink plenty of fluids and avoid long periods of "holding urine."
- Caution against tight underwear; children should wear cotton rather than nylon underwear.
- Encourage the child to void more frequently and to fully empty the bladder.
- Discourage bubble baths, bath oils, and hot tubs, which can irritate the urethra.
- Instruct sexually active adolescent girls to void before and after sexual intercourse to prevent urinary stasis and flush out bacteria introduced during intercourse.

Give parents specific guidelines for oral fluid intake. Make sure the amount of fluids recommended for a 24-hour period equals the maintenance fluids needed plus additional fluids required because of fever and diuresis to flush out pathogens. (See Chapter 43. ∞) Suggest that the parents avoid giving the child caffeinated and carbonated beverages as these may potentially irritate the bladder mucosa.

Encourage the child to void more frequently even after the infection has cleared. A wristwatch with an alarm may be a helpful reminder. The child with a neurogenic bladder needs to have clean intermittent catheterization performed several times a day to reduce urinary stasis and the potential for UTI.

Teach parents the signs and symptoms of recurrent infection and to seek care promptly.

EVALUATION

Expected outcomes of nursing care include:

- The child increases fluid intake and number of times voiding each day.
- Future UTIs are prevented.

ENURESIS

Enuresis is repeated involuntary voiding by a child old enough that bladder control is expected, usually about 5 to 6 years of age. (See Table 52–2 for bladder control milestones.) Enuresis can occur either at night (nocturnal), during the day (diurnal), or both night and day. Nocturnal enuresis accounts for approximately 50% of cases and occurs more often in boys than in girls, with a 3.5:1 ratio, whereas diurnal enuresis is more common in girls. Enuresis can be primary, intermittent, or secondary. In primary

TABLE 52-2 ❖ **Milestones in the Development of Bladder Control**

Age	Developmental Milestone
1½ years	Child passes urine at regular intervals.
2 years	Child announces when he or she is voiding.
2½ years	Child makes known need to void; can hold urine.
3 years	Child goes to the bathroom by himself or herself; holds urge if preoccupied with play.
2½-3½ years	Child achieves nighttime control.
4 years	Child shows great interest in going to bathrooms when away from home (shopping centers, movies).
5 years	Child voids approximately 7 times a day; prefers privacy; is able to initiate emptying of bladder at any degree of fullness.

Care Plan: A School-Age Child with Enuresis



MEDIA LINK

enuresis the child has never had a dry night. It is thought to be due to a maturational delay and small functional bladder, not stress or a psychologic cause. In intermittent enuresis the child has occasional nights or periods of dryness. With secondary enuresis a child who has been reliably dry for 6 to 12 months begins bed-wetting. It is associated with stress, infections, and sleep disorders. Between 5 and 7 million children older than 5 years have primary nocturnal enuresis (Mercer, 2003).

Enuresis may result from neurologic or congenital structural disorders, illness, or stress. Nocturnal enuresis occurs frequently in children whose parents have a history of bed-wetting. There is a 77% risk if both parents had enuresis, a 44% risk if one parent had enuresis, and a 15% risk if neither parent had enuresis (Tobias, 2000). In most children with primary enuresis, the bladder has a smaller functional capacity, and neuromuscular maturation of the inhibitory fibers is delayed. Often children with nocturnal enuresis are harder to arouse and may fail to respond to full bladder signals. Some children may produce more urine and exceed the functional bladder capacity due to a lack of circadian rhythm of vasopressin that helps concentrate the urine during sleep (Jalkut, Lerman, & Churchill, 2001). Minor abnormalities of the

bladder neck and urethra are also associated with enuresis. Some children are believed to have mild developmental delays. Children with obstructive sleep apnea have a higher rate of enuresis (Brooks & Topol, 2003). The majority of cases are not associated with structural or neurologic pathology.

Children with diurnal enuresis may have frequency, urgency, constant dribbling, and involuntary loss of control after voiding. Children with nocturnal enuresis have bed-wetting.

Diabetes mellitus or renal insufficiency should be ruled out in children with both enuresis and polyuria or oliguria. The child's lower spine is examined for fistulas, sacral dimples, or tufts of hair that could be signs of occult spina bifida. Prolonged hospitalization, family stressors, and preoccupation with school concerns also have been associated with secondary enuresis.

A thorough history can help identify potential causes of enuresis (see "Nursing Practice"). Enuretic children of-

NURSING PRACTICE

QUESTIONS TO ASK WHEN TAKING AN ENURESIS HISTORY

Family History

Is there a family history of renal or urinary structural abnormalities?

Is there a family history of bed-wetting?

Family Management

How serious is the problem for the family?

What happens when the child wets? (Who gets up and changes sheets?)

How is the child treated? Is the child punished or blamed for wetting?

What remedies have been tried?

Toilet Training

Did the child have a difficult time with toilet training?

What method of toilet training did you use? When was toilet training initiated?

What are the child's current voiding and stooling patterns?

How long is the child's longest dry period, and when does it occur?

Does the child have a history of constipation or encopresis?

Stressors

How is the child doing in school? How are relationships with peers?

Are any new or chronic stressors present in the child's life?

How does the problem interfere with play and other activities?

Risk Factors

Diabetes

■ Does the child void often or have urgency?

■ Is the child frequently thirsty?

Urinary Tract Infection

■ Does the child experience burning on urination?

■ Has the child had a urinary tract infection before?

GROWTH AND DEVELOPMENT

An estimated 15% to 20% of children who are partially toilet trained will continue to have wetting episodes after 5 years of age. An estimated 5% of 10-year-olds and 2% of 12- to 14-year-olds continue to have nocturnal enuresis (Issenman, Filmer, & Gorski, 1999).

ten have a history of constipation. Rectal pressure on the posterior bladder wall stimulates the bladder to empty. Laboratory evaluation includes urinalysis and urine culture. Measurement of the child's functional bladder capacity may be performed. Bladder sonography to measure residual urine after voiding and uroflow (the rate of urine flow) measurement to identify a slow urine stream may be performed (Jalkut et al., 2001).

A multitreatment approach is usually most effective. Fluid restriction, bladder training, and enuresis alarms are common approaches (Table 52-3). A spontaneous cure happens in 15% of children each year, regardless of intervention or lack of intervention. Approximately one third of children with nocturnal enuresis are treated with medications. Imipramine, a tricyclic antidepressant, is often used but requires close monitoring because of its effects on mood and sleep-arousal patterns and the associated danger of overdoses. Desmopressin, given as a nasal spray or oral tablet, has an antidiuretic effect but is

not used long term because of its expense. It is usually reserved for times when the child is away from home for a short period (e.g., sleepovers or camp). Relapse often occurs when medications are stopped. Avoiding foods believed to contribute to enuresis, such as those containing caffeine, milk, chocolate, and citrus, may be helpful (Tobias, 2000).

NURSING MANAGEMENT

Teach the child and parents about the physiologic development of bladder control and causes and treatment of enuresis. Explore feelings of guilt or blame. Make sure the parents are aware that the child cannot control the wetting. Psychosocial support is an essential part of care since stress is an important cause of secondary enuresis. Provide emotional support to the parents and child, and encourage the child's participation in the treatment plan. Refer the child for counseling or therapy if appropriate.

Assess the parents' and child's motivation and readiness for interventions. Before parents buy an enuresis alarm, suggest they use an alarm clock in the child's room for several nights to see if the child will arouse. Find out whether the child shares a room with others who will be disturbed by the alarm. Ask if the child and parents are willing to persist with an enuresis alarm, as it may take months to work. Evaluation of nursing care includes families choosing the intervention best for them, and an increase in the number of dry nights.

TABLE 52-3 ✦ **Treatment Approaches for Enuresis**

Approach	Description
Fluid restriction	Fluid intake is limited in the evening and before the child goes to bed.
Bladder exercises	The child drinks a large amount and then holds urine as long as he or she can. The child practices stopping voiding midstream. Exercises should continue for at least 6 months.
Timed voiding	The child with diurnal enuresis is instructed to void every 2 hours and to use a double voiding pattern; this trains the bladder to empty completely and avoid overdistention.
Enuresis alarms	A detector strip is attached to the child's pants. The alarm sounds a buzzer that alerts the child when wetting occurs, so the child can get up and finish voiding in the bathroom. This works best for children over 7 years old, and takes 3 to 4 months for success.
Reward system	Set realistic goals for the child and reinforce dry days or nights with stars and stickers on a chart.
Medications	Imipramine is prescribed nightly for 2 to 4 months and then tapered over several months to reduce the rate of relapse. It is effective in 50% to 70% of children. Desmopressin is prescribed to children with nocturnal enuresis for special events such as camp or sleepovers. Oxybutynin is used for diurnal enuresis to relieve urgency and frequency from bladder irritability.

✦ RENAL DISORDERS

NEPHROTIC SYNDROME

Nephrotic syndrome refers not to a specific disease, but rather to a clinical state characterized by edema, massive proteinuria, hypoalbuminemia, hypoproteinemia, hyperlipidemia, and altered immunity. Congenital nephrotic (CNF) syndrome, an autosomal recessive disorder, is extremely rare. The CNF gene is localized on the long arm of chromosome 19 (19q 13.1) (Goodyer & Kashtan, 1998). Primary nephrotic syndrome results from a disease that affects only the kidney, such as glomerulonephritis.

Approximately 85% of children with nephrotic syndrome have a type of primary disease called minimal change nephrotic syndrome (MCNS) (Huether, 2002). MCNS usually occurs in children between the ages of 2 and 7 years, with an incidence of 2 per 100,000 children, and it is more common in males than females. African-American and Hispanic children experience a greater incidence of nephrotic syndrome, and the disorder in these children is more virulent, progresses more rapidly to renal failure, and has a poorer prognosis (Robinson, Nahata, Mahan et al.,

2003). MCNS derives its name from the normal or only minimally changed appearance of the glomeruli on light microscopic evaluation. Because MCNS is the most common form of nephrotic syndrome, it is the focus of the following discussion.

ETIOLOGY AND PATHOPHYSIOLOGY

The cause of primary MCNS is unknown, but an immune system role is strongly suspected because an upper respiratory infection often precedes the onset of edema by 2 to 3 days (Robinson et al., 2003). The mechanism of increased glomerular permeability is unknown as the glomeruli appear normal; however, it may be related to the loss of a negative charge in the glomerular capillary wall (Huether, 2002). In MCNS increased permeability of the glomerular membrane permits large, negatively charged molecules such as albumin to pass through the membrane and be excreted in the urine. Proteinuria results in decreased oncotic pressure and edema, because fluid remains in the interstitial spaces instead of being pulled back into the vascular compartment (Robinson et al., 2003). Immunoglobulins are lost, resulting in altered immunity. Loss of protein in the urine, insufficient albumin production by the liver, and a decreased albumin concentration as a result of salt and water retention by the kidney contribute to hypoalbuminemia. Hypercoagulability occurs because of loss of antithrombin III in the urine and reduced levels of factors IX, XI, and XII. The liver, stimulated perhaps by hypoalbuminemia or decreased osmotic pressure, responds by increasing synthesis of lipoprotein, resulting in hyperlipidemia.

CLINICAL MANIFESTATIONS

In most children, edema develops gradually over several weeks. Children may have a history of periorbital edema on waking that resolves during the day as fluid shifts to the abdomen and lower extremities. Other signs include snug fit of clothing and shoes, pallor, hypertension, irritability, anorexia, hematuria, decreased urine output, and nonspecific malaise. The child's urine may be frothy or foamy. Parents often do not seek medical treatment until generalized edema develops on the child's extremities, abdomen, or genitals (Figure 52-4). Respiratory distress from pleural effusion may occur in some cases.

Massive edema resulting in a dramatic weight gain and abdominal pain, with or without vomiting, may occur, depending on the amount of albumin lost and the amount of sodium ingested. The child becomes malnourished as a result of protein loss in the urine. The skin is pale and shiny with prominent veins, and the hair becomes more brittle. An increased risk of thrombosis is present.

● **FIGURE 52-4**



This boy has generalized edema, a characteristic finding in nephrotic syndrome.

CLINICAL THERAPY

Diagnosis is based on the history, characteristic symptoms, and laboratory findings. Serum albumin and sodium are decreased. Serum blood urea nitrogen (BUN), cholesterol, and electrolytes may be ordered. Urinalysis reveals massive proteinuria (50 mg/kg/day), the primary indicator of nephrotic syndrome. Microscopic hematuria may also be present. Renal ultrasound and a renal biopsy may be performed in some cases.

NURSING PRACTICE

A protein-to-creatinine (PR/CR) ratio of the first morning void is used to estimate protein excretion in children because of the challenges in obtaining 24-hour urines. **Normal PR/CR ratios are less than 0.2 in children over 2 years and less than 0.5 in children 6 months to 24 months of age** (Hogg, Furth, Lemley, et al., 2003).

Children may be hospitalized when severe edema or a major infection is present, but are usually treated as outpatients. Clinical therapy focuses on decreasing proteinuria, relieving edema, managing associated symptoms, improving nutrition, and preventing infection. A corticosteroid (such as prednisone) is prescribed to decrease proteinuria. In most children, urine protein levels fall to trace or negative values within 2 to 3 weeks of the start of therapy. Children who respond successfully to therapy continue to take corticosteroids daily for 6 weeks, and then 6 weeks of alternate-day treatment. Approximately 90% of children experience complete remission with corticosteroid therapy.

DRUG GUIDE

PREDNISON

Overview of Action

Natural or synthetic, intermediate-acting glucocorticoid that has strong anti-inflammatory, immunosuppressant, and metabolic actions. Treats diseases such as renal, connective tissue, dermatologic, allergy, acute leukemia, and respiratory distress syndrome.

Routes, Dosage, Frequency

PO:

- 0.5 to 2 mg/kg/day in equally divided doses 4 times a day (maximum dose 80 mg/day).
- Nephrosis: 2 mg/kg/dose 1 to 3 times per day until urine is protein free for 5 days or for 28-day course (maximum of 80 mg/day). For persistent proteinuria may increase to 4 mg/kg/dose every other day for additional 28 days.
Maintenance: 2 mg/kg/dose every other day for 28 days. To discontinue: taper over 4 to 6 weeks (Hogg, Portman, Milliner et al., 2000).
- Asthma: Acute: 1 to 2 mg/kg/day in 1 to 2 divided doses for 3 to 5 days, or under 1 year, 10 mg every 12 hours; 1 to 4 years, 20 mg every 12 hours; 5 to 13 years, 30 mg every 12 hours; over 13 years, 40 mg every 12 hours (maximum dose of 60 mg/day). Severe: 5 to 10 mg/day or 10 to 30 mg every other day, taper to aerosol corticosteroids.

Note: Dosage is based on child's response to drug and severity of condition rather than strictly on weight or body surface.

Contraindications: Hypersensitivity to the drug and systemic fungal infection.

Side Effects: Usually dependent upon dosage and duration of treatment, but includes possible growth suppression, hypertension, hyperglycemia, peptic ulcer, congestive heart failure, psychotic behavior, increased appetite, impaired wound healing, and cushingoid features.

Nursing Implications

- **Assess:** Obtain baseline weight and height, blood pressure, intake and output ratio and pattern. Take the blood pressure twice a day during initial stabilization period and report an ascending pattern. Obtain a fasting glucose, electrolytes, and routine laboratory studies at regular intervals.

- **Administer:** PO: It is best to give a daily dose before 9 a.m. Alternate-day therapy is recommended to reduce growth-retarding effects. Give with food or milk to reduce gastrointestinal irritation. Tablets can be crushed and mixed with small amounts of food or fluid. Tablets are very bitter. If child is able to swallow capsules, they can be placed in a gelatin capsule. Follow with fluid of choice to cleanse child's palate.
- **Monitor:** Carefully assess child's response to drug to determine need for dosage adjustments. Observe for side effects, especially hypocalcemia, signs of adrenal insufficiency, symptoms of infection, or worsening of condition. Monitor blood pressure and daily weights; report any sudden weight gain to the physician. With long-term usage, monitor serum electrolytes, height (to evaluate impact of medication on growth), and bone density. Encourage a well-balanced diet low in sodium, and encourage good hygiene and dental care (possible oral fungal infections). To discontinue the medication, reduce the dose gradually, especially after long-term use, so it does not cause acute life-threatening adrenal insufficiency.
- **Patient Teaching:** Do not alter dose or stop medication abruptly as it could cause serious side effects or even death. Gradual tapering of dosage is necessary. Increasing the amount of medication will not speed the healing process. Monitor signs and symptoms of medication reactions; report signs of gastrointestinal distress, symptoms of adrenal insufficiency, or worsening of condition to physician. Obtain weekly weights; report a weight gain of 2 kg (5 lb) to physician. Stress importance of close medical supervision and follow-up. Get regular ophthalmologic examinations if on long-term therapy. Live vaccine immunizations should not be given when on high doses of corticosteroids. Inform any healthcare provider, including dentists, surgeons, or emergency care personnel, that child is on medication. Child should carry medical identification card. Observe for symptoms of infection. Do not use over-the-counter medications unless approved by the healthcare provider.

Data from Bindler, R. M., Howry, L. B., Wilson, B. A., et al. (2005). Pediatric drugs and nursing implications. Upper Saddle River, NJ: Prentice Hall-Health.

Relapses commonly happen with a respiratory infection or live virus immunizations; however, relapses become less frequent or stop during puberty. Children who have a relapse after drug therapy is discontinued get repeat therapy. Other medications used include diuretics, antihypertensive agents, and antibiotics. Alkylating agents (cyclophosphamide and chlorambucil) or cyclosporine may be used when nephrotic syndrome is resistant to corticosteroids. Since diuretics can precipitate hypovolemia, hyponatremia, and hypokalemia, electrolyte levels should be carefully monitored. Intravenous administration of albu-

min may occasionally be ordered in the child with massive edema who is resistant to diuretics (Robinson et al., 2003). Analgesics may be ordered for pain related to edema or flank pain from a urinary tract infection.

A normal diet for the child's age is recommended. No attempt should be made either to restrict or to increase protein intake. A "no added salt" diet is recommended during corticosteroid treatment as these children have an elevated total body sodium even though serum sodium concentrations are low (Hogg, Portman, Milliner et al., 2000).

NURSING MANAGEMENT

NURSING ASSESSMENT AND DIAGNOSES

Physiologic Assessment

Careful assessment of the child's hydration status and edema is essential. Carefully monitor intake and output. Weigh the child daily using the same scale, and measure abdominal girth to monitor changes in edema and ascites (see Skill 9-7 **SKILLS**). Monitor vital signs every 4 hours to watch for signs of respiratory distress, hypertension, or circulatory overload. Test urine for proteinuria and specific gravity at least once each shift. Assess for hypovolemia during periods of diuresis. Assess for skin breakdown.

Psychosocial Assessment

Children and parents are often fearful or anxious on admission. Because edema often develops gradually, parents may feel guilty if they did not seek medical attention immediately. School-age children with generalized edema are often concerned about their appearance. Careful questioning may be necessary to elicit these concerns. The child hospitalized for a recurrence of nephrotic syndrome may be frustrated or depressed. Assess individual and family coping mechanisms, support systems, and level of stress.

Common nursing diagnoses for the child with MCNS include the following:

- *Risk for Infection* related to immunosuppressive therapy
- *Risk for Impaired Skin Integrity* related to edema, lowered resistance to infection and injury, immobility, and malnutrition
- *Excess Fluid Volume* related to renal dysfunction and sodium retention
- *Imbalanced Nutrition: Less than Body Requirements* related to loss of appetite and protein loss in urine
- *Fatigue* related to fluid and electrolyte imbalance, albumin loss, altered nutrition, and renal failure
- *Deficient Diversional Activity* related to fatigue, immobility, and social isolation

PLANNING AND IMPLEMENTATION

Nursing care is mainly supportive and focuses on administering medications, preventing infection, preventing skin breakdown, meeting nutritional and fluid needs, promoting rest, and providing emotional support to the parents and child.

Administer Medications

It is important to give prescribed medications at the scheduled times. Watch for side effects of corticosteroids such as

moon face, increased appetite, increased hair growth, abdominal distention, and mood swings, as well as adverse effects such as hypertension, nausea, and hyperglycemia. If the child is receiving albumin intravenously, monitor closely for hypertension or signs of volume overload caused by fluid shifts. If diuretics are used, observe for shock. The child may need to have albumin infused simultaneously with diuretics.

Prevent Infection

Children with MCNS are at risk for infection because of the loss of immunoglobulins in the urine and corticosteroid therapy. Careful handwashing is important. Use standard precautions. Strict aseptic technique is essential during invasive procedures. Monitor the child's white blood cell count when cytotoxic drugs are given as bone marrow suppression is a side effect. Monitor vital signs carefully to detect early signs of infection that may be masked by corticosteroid therapy. Decrease the child's social contacts during immunosuppressive treatment, and caution parents and children to avoid exposure to people with respiratory infections and communicable diseases. Emphasize the importance of avoiding shopping malls, sporting arenas, grocery stores, game stores, and other public areas where the risk of exposure to such infections is increased.

Prevent Skin Breakdown

Meticulous skin care is essential to prevent skin breakdown and potential infection. Assess the skin repeatedly, turn the child frequently, and use therapeutic mattresses (e.g., egg crate, airflow) to help prevent skin breakdown. Keep the skin clean and dry.

Meet Nutritional and Fluid Needs

Keep the child's food preferences in mind when planning menus. Encourage the child to eat by presenting attractive meals with small portions. Socialization during meals may improve the child's appetite. Fluids are not usually restricted except during severe edema.

Promote Rest

Provide opportunities for quiet play as tolerated, such as drawing, playing board games, listening to tapes, and watching videos. Adjust the child's daily schedule to allow rest periods after activities. Signs of fatigue may include irritability, mood swings, or withdrawal. Tell the parents and child about the importance of rest. Limiting visitors during the acute phase of the illness may be necessary. Telephone and computer contacts may be encouraged as an alternative to visitors. To provide a sense of control, encourage the child to set his or her own limits on activity.



Provide Emotional Support

Parents and children often need support to cope with this chronic disease. Thoroughly explain the child's disease and treatment regimen to parents. Parental anxiety in combination with the hospitalization may interfere with the child's independence. Help parents promote the child's independence by allowing the child to choose from the menu or to select the daily activity schedule. This gives the child some sense of control.

Children with MCNS may have a distorted body image because of sudden weight gain and edema. They may refuse to look in the mirror, refuse to participate in care, and take less interest in their appearance. Encourage children to express their feelings. Help them maintain a normal appearance by promoting normal grooming routines. Encourage children to wear their own pajamas rather than hospital gowns. Scarves or hats may be used to lessen the child's edematous appearance. Adolescents can be encouraged to write their feelings in a journal as a coping mechanism.

Discharge Planning and Home Care Teaching

Explain the disease process, prognosis, and treatment plan to parents and school-age children. Make sure parents know how to administer medications and can identify potential side effects. Inform parents about restricting fluid intake until the edema resolves. Instruct parents about the need to monitor urine daily for protein, and have them keep a diary to record results. Monitoring the child's weight each week may help identify early stages of fluid retention. This helps parents to spot a relapse before edema occurs.

Tutoring may be required for a short period after discharge. However, encourage parents to allow the child to return to normal activities once the acute episode has resolved. Emphasize the importance of avoiding contact with people with infectious diseases, because of the child's reduced immunity. Reinforce to parents that it is important to follow the "no added salt" diet as long as the child is receiving corticosteroid therapy or shows signs of MCNS. Warn them that steroids stimulate appetite, so they need to control the child's food intake and weight gain. No live immunizations should be given to the child who is relapsing or taking corticosteroid therapy. Withhold immunizations until 6 months after the completion of corticosteroid therapy. Although immunizations may trigger a relapse, pneumococcal vaccine and other immunizations are important to protect the child from serious preventable infections.

Most children do well with corticosteroid therapy; however, relapses are common. Even children with frequent relapses usually have a spontaneous resolution of MCNS before 30 years of age.

EVALUATION

Expected outcomes of nursing care include:

- The child responds to corticosteroid therapy.
- Dietary guidelines of "no added salt" are followed and food intake is controlled during corticosteroid therapy.
- Relapses are identified by parents before edema occurs.
- The child receives the additional recommended immunizations.

A discussion of Wilms' tumor can be found in Chapter 50. ∞

RENAL FAILURE

Renal failure, which may be acute or chronic, occurs when the kidney is unable to excrete wastes and concentrate urine. Acute renal failure occurs suddenly (over days or weeks) and may be reversible, whereas in chronic renal failure, kidney function diminishes gradually and permanently over months or years.

Both types of renal failure are characterized by **azotemia** (accumulation of nitrogenous wastes in the blood) and sometimes **oliguria** (urine output less than 0.5 to 1 mL/kg/hr), indicating the kidney's inability to excrete metabolic waste products. The degree of renal impairment is estimated by the glomerular filtration rate (Hogg, Furth, Lemley et al., 2003). **Uremia** occurs when there is an excess of urea and other nitrogenous waste products in the blood.

ACUTE RENAL FAILURE

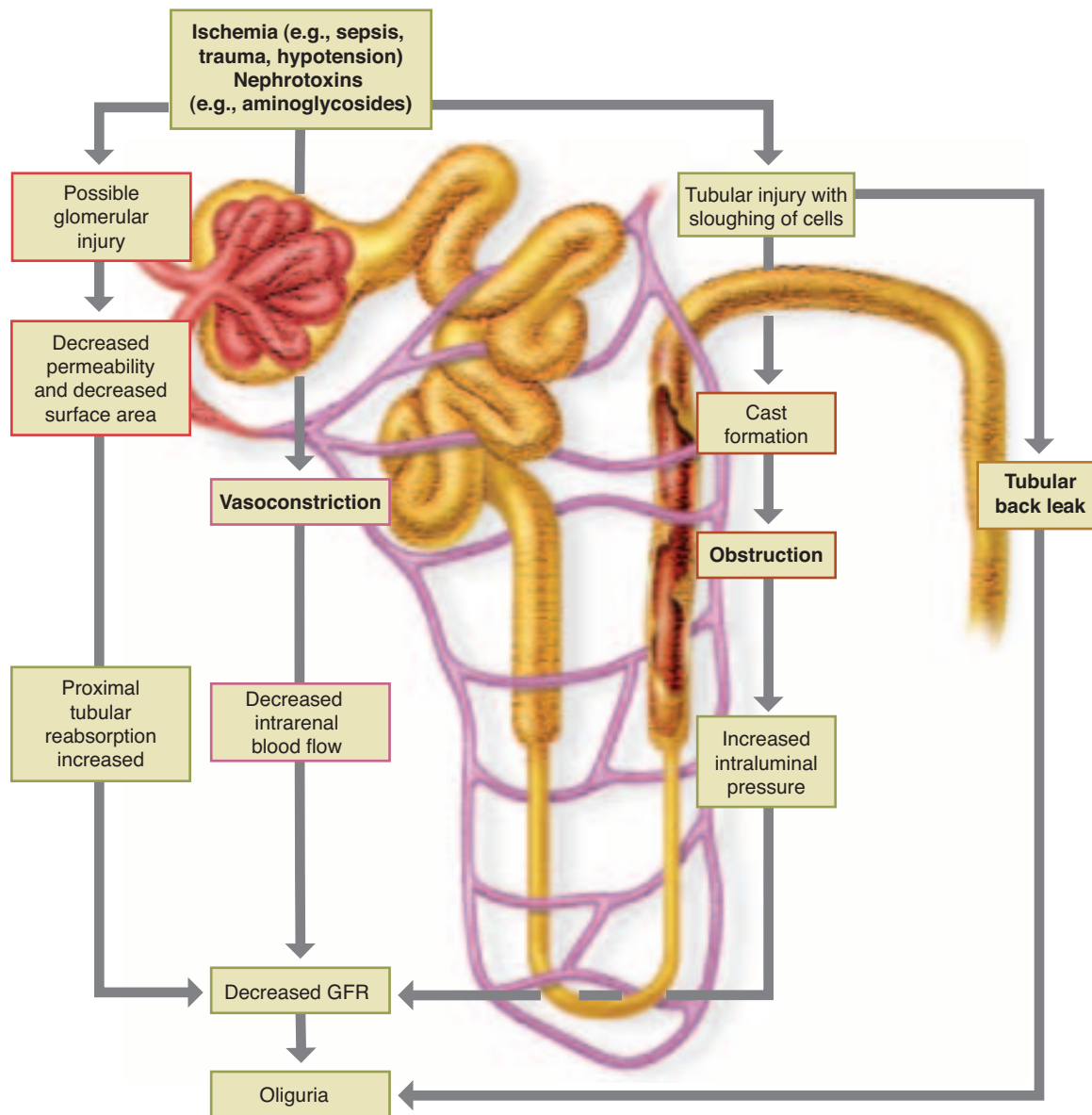
Acute renal failure (ARF), in which kidney function abruptly diminishes, is characterized by a rapid rise in the BUN level. The kidneys are also unable to regulate extracellular fluid volume, sodium balance, and acid-base homeostasis. ARF is seen in 2% to 3% of children cared for in pediatric intensive care units, and up to 8% of infants cared for in neonatal intensive care units (Vogt & Avner, 2004). Potential causes include sepsis, poisoning, hemolytic uremic syndrome, hypovolemia, obstructive uropathy, and complication of cardiac surgery.

ETIOLOGY AND PATHOPHYSIOLOGY

ARF may be caused by prerenal or postrenal factors as well as actual kidney damage. Prerenal ARF is a result of decreased perfusion to an otherwise normal kidney in association with a systemic condition. Hypovolemia (hemorrhage or dehydration), septic shock, or cardiac failure may precipitate prerenal ARF. This is the most common type of ARF in infants and young children.

PATHOPHYSIOLOGY ILLUSTRATED

Acute Renal Failure



The initial kidney injury is usually associated with an acute condition such as sepsis, trauma, and hypotension, or the result of treatment for an acute condition with a nephrotoxic medication. Injury to the kidney can occur because of glomerular injury, vasoconstriction of capillaries, or tubular injury. All consequences of injury lead to decreased glomerular filtration and oliguria.

ARF resulting from primary kidney damage (intrinsic) may be caused by infection, diseases such as hemolytic-uremic syndrome or acute glomerulonephritis, cortical necrosis, nephrotoxic drugs, or accidental ingestion of drugs or poisons. The structure most susceptible to damage is the kidney tubule. Injury to the tubule resulting in

acute tubular necrosis is the most frequent cause of intrinsic renal failure in children.

Postrenal ARF is caused by obstruction of the urinary flow from both kidneys, such as occurs in posterior urethral valves or a neurogenic bladder. Children may have oliguria, or normal or increased urine output. Renal failure

NURSING PRACTICE

Nephrotoxic drugs include the following:

- Antimicrobials: aminoglycosides, cephalosporins, tetracycline, sulfonamides
- Radiographic contrast media with iodine
- Heavy metals: lead, barium, iron
- Nonsteroidal anti-inflammatory drugs: indomethacin, aspirin

without oliguria usually indicates a less severe renal injury. Children who recover from ARF may have residual kidney damage and compromised renal function.

CLINICAL MANIFESTATIONS

Characteristically, a healthy child suddenly becomes ill with nonspecific symptoms that indicate a significant illness or injury (e.g., nausea, vomiting, lethargy, edema, gross hematuria, oliguria, and hypertension). These symptoms are a result of electrolyte imbalances, uremia, and fluid overload. The child appears pale and lethargic. See the “Clinical Manifestations” tables for more information.

CLINICAL MANIFESTATIONS

ACUTE VERSUS CHRONIC RENAL FAILURE

TYPE OF RENAL FAILURE	CLINICAL MANIFESTATIONS
Acute renal failure	Gross hematuria, headache, edema, crackles, gallop heart rhythm, hypertension, hematuria, lethargy, nausea and vomiting, oliguria Mass in flank area if a cyst, tumor, or obstructive lesion is present
Chronic renal failure	Fatigue, malaise, poor appetite, nausea and vomiting, failure to thrive or short stature Headache, decreased mental alertness or ability to concentrate Secondary enuresis, chronic anemia, hypertension, edema Fractures with minimal trauma, rickets, valgus deformity

CLINICAL MANIFESTATIONS

ELECTROLYTE IMBALANCES IN ACUTE AND CHRONIC RENAL FAILURE

ELECTROLYTE IMBALANCE AND CAUSE	CLINICAL MANIFESTATIONS
<p>Hyperkalemia Results from inability to adequately excrete potassium derived from diet and catabolized cells. In metabolic acidosis, potassium also moves from intracellular fluid to extracellular fluid.</p>	<ul style="list-style-type: none"> ■ Peaked T waves, widening of QRS waves on ECG. ■ Dysrhythmias: ventricular dysrhythmias, heart block, ventricular fibrillation, cardiac arrest ■ Diarrhea ■ Muscle weakness
<p>Hyponatremia In the acute oliguric phase, hyponatremia is related to the accumulation of fluid in excess of solute.</p>	<ul style="list-style-type: none"> ■ Change in level of consciousness ■ Muscle cramps ■ Anorexia ■ Abdominal reflexes, depressed deep tendon reflexes ■ Cheyne-Stokes respirations ■ Seizures
<p>Hypocalcemia Phosphate retention (hyperphosphatemia) due to impaired renal function depresses the serum calcium concentration. Calcium is deposited in injured cells. Hyperkalemia and metabolic acidosis may mask the common clinical manifestations of severe hypocalcemia.</p>	<ul style="list-style-type: none"> ■ Muscle tingling ■ Changes in muscle tone ■ Seizures ■ Muscle cramps and twitching ■ Positive Chvostek sign (contraction of facial muscles after tapping facial nerve just anterior to parotid gland)

Hyperkalemia is the most life-threatening electrolyte disorder associated with ARF. Hyponatremia affects central nervous system function, resulting in symptoms that range from fatigue to seizures. Edema occurs as a result of sodium and water retention. (Refer to Chapter 43 for a discussion of these fluid and electrolyte alterations. ∞) Children with ARF are also more susceptible to infection because of depressed immune functioning.

CLINICAL THERAPY

Diagnosis of renal failure is based primarily on urinalysis and blood chemistry results, including BUN, serum creatinine, sodium, potassium, and calcium levels (Table 52–4). The kidneys are normal in size, and no signs of renal **osteodystrophy** (increased resorption of bone caused by chronic hyperparathyroidism) are found on x-ray. Various imaging studies to assess kidney structures, renal blood flow, and renal perfusion and function may be performed to determine whether the child has ARF or chronic renal failure. A renal biopsy may be required.

Treatment depends on the underlying cause of the renal failure. The goal is to minimize or prevent permanent renal damage while maintaining fluid and electrolyte balance and managing complications. Initial emergency treat-

ment of children with fluid depletion focuses on rapid fluid replacement at 20 mL/kg of saline or lactated Ringer's solution given over 5 to 10 minutes and repeated as needed to ensure renal perfusion. Albumin may also be administered when blood loss is the cause of circulatory depletion. If oliguria persists after restoration of adequate fluid volume, intrinsic renal damage is suspected.

Children with fluid overload, like those with pulmonary edema, need diuretic therapy, and dialysis if they respond poorly to diuretics. Fluid requirements are calculated to maintain *zero water balance* (intake should equal output). Eliminate all potential sources of potassium intake until hyperkalemia is controlled (see Chapter 43 ∞). Other electrolyte imbalances are treated. Nutrition must be maintained with extra carbohydrate intake during the catabolic state. Antibiotics are prescribed for infection. Nephrotoxic antibiotics such as aminoglycosides are avoided (Table 52–5).

Children whose ARF is unresponsive to management require dialysis to correct severe electrolyte imbalances, manage fluid overload, and cleanse the blood of waste products. The clinical situation and age of the child determine whether hemodialysis or peritoneal dialysis is used. Refer to the “Renal Replacement Therapy” section on page 1653.

Prognosis depends on the cause of ARF. When renal failure results from drug toxicity or dehydration, the prognosis is generally good. However, ARF that results from diseases such as hemolytic-uremic syndrome or acute glomerulonephritis may be associated with residual kidney damage.

TABLE 52–4 ❖ **Diagnostic Tests for Renal Failure**

Test	Normal Values	Findings in Renal Failure
Urinalysis		
pH	4.5–8	Lowered
Osmolarity	50–1400 mOsm/L	> 500 prerenal < 350 intrinsic
Specific gravity	1.001–1.030	High: prerenal ARF Low: intrinsic ARF Normal: postrenal ARF
Protein	Negative	Positive
Blood Chemistry		
Potassium	3.5–5.8 mmol/L	Elevated
Sodium	135–148 mmol/L	Normal, low, or high, depends solely on the amount of water in the body
Calcium	2.2–2.7 mmol/L	Low
Phosphorus	1.23–2 mmol/L	High
Urea nitrogen	3.5–7.1 mmol/L	Increased
Creatinine	0.2–0.9 mmol/L	Increased
pH	7.38–7.42	Low acidic

ARF: acute renal failure

NURSING MANAGEMENT

NURSING ASSESSMENT AND DIAGNOSES

A complete history and physical examination are necessary to identify progression of symptoms and possible causes for renal failure.

Physiologic Assessment

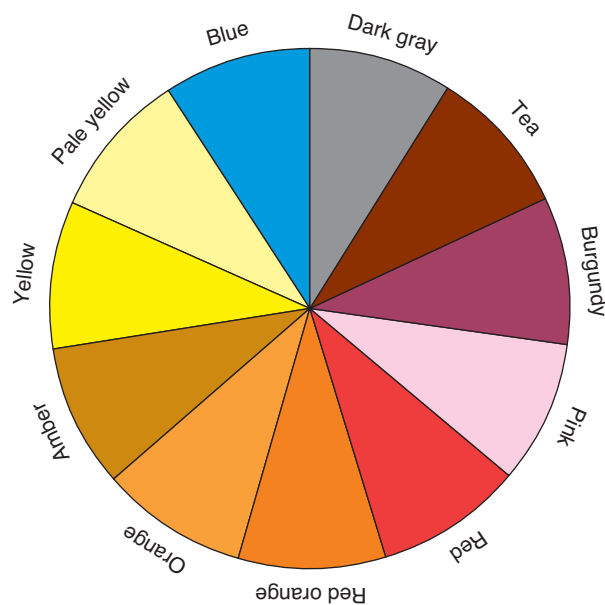
Assess vital signs, level of consciousness, and other neurologic indicators to help identify clinical signs of electrolyte imbalance (see “Clinical Manifestations: Electrolyte Imbalances in Acute and Chronic Renal Failure” on page 1645). Measure the child's weight on admission to provide a baseline for evaluating changes in fluid status. Monitor urinalysis, urine culture, and blood chemistry studies. Inspect urine for color (Figure 52–5 ●). Cloudy urine may indicate infection; tea-colored urine suggests hematuria. Assess urine specific gravity and intake and output.

Psychosocial Assessment

The unexpected and acute nature of the child's hospitalization creates anxiety for both parents and child. Assess for feel-

TABLE 52-5 ❁ Medications Used to Treat Complications of Acute Renal Failure

Complication	Medication	Action or Indication	Nursing Implications
Hyperkalemia (> 5.8 mmol/L)	Kayexalate Calcium gluconate 10%	Exchanges sodium for potassium Counteracts potassium-induced increased myocardial irritability	May require up to 4 hours to take effect. Monitor for ECG changes. Intravenous infiltration may result in tissue necrosis.
	Albuterol	Shifts potassium to the cells	Give by aerosol.
Metabolic acidosis	Sodium bicarbonate or sodium citrate	Helps correct metabolic acidosis by exchanging hydrogen for potassium	<i>Do not mix with calcium.</i> Complications include fluid overload, hypertension, and tetany.
Hypocalcemia (< 2.2 mmol/L)	Calcium gluconate 10%	Used in presence of tetany; provides ionized calcium to restore nervous tissue function to control serum phosphorus	Administer slowly to prevent bradycardia. Monitor for ECG changes.
Malignant hypertension (blood pressure $> 95\%$ for age, sex, and height percentile)	Sodium nitroprusside, nitroglycerin	Relaxes smooth muscle in peripheral arterioles	Administer by continuous intravenous infusion; fall in blood pressure is seen within 10–20 minutes.

FIGURE 52-5

A color wheel, such as the one shown here, can be used as a guide in standardizing descriptions of urine color. Normal urine is pale yellow. Changes in urine color can indicate the following alterations: *yellow*—concentrated urine; *amber*—bile in urine; *orange*—alkaline or concentrated urine; *red-orange*—acid pH, medications; *red*—blood, menses; *pink*—dilute blood; *burgundy*—laxatives; *tea*—melanin, hematuria; *dark gray*—medications, dyes; *blues*—dyes, medications.

Used with permission from Cooper, C. (1993). What color is that urine specimen? American Journal of Nursing, 93, 37 Copyright © 1993 Connie Cooper, R.N., M.S.N.; graphics by Mike O'Grady, R.N., M.S.N.

ings of anger, guilt, or fear associated with the hospitalization. Such feelings are likely if ARF developed as a result of dehydration, a preventable injury, or poisoning. Assess coping mechanisms, family support systems, and level of stress.

Several nursing diagnoses may apply to the child with ARF, including the following:

- *Ineffective Renal Tissue Perfusion* related to hypovolemia, sepsis, or drug toxicity
- *Excess Fluid Volume* related to renal dysfunction and sodium retention
- *Imbalanced Nutrition: Less than Body Requirements* related to anorexia, nausea, vomiting, and catabolic state
- *Risk for Infection* related to invasive procedures and monitoring equipment, and diminished immune functioning
- *Compromised Family Coping* related to sudden hospitalization and uncertain prognosis of child

PLANNING AND IMPLEMENTATION

Nursing care focuses on preventing complications, maintaining fluid balance, administering medications, meeting nutritional needs, preventing infection, and providing emotional support to the child and parents.

Prevent Complications

Complications are best prevented by ensuring compliance with the treatment plan. Careful monitoring of vital signs,

intake and output, serum electrolytes, and level of consciousness can alert the nurse to changes that indicate potential complications. For example, if the serum sodium concentration rises and weight falls, insufficient fluids are being administered. If the serum sodium level falls and the weight increases, excessive fluids are being administered.

Maintain Fluid Balance

Estimate the child's fluid status by daily monitoring the weight (on the same scale at same time of day), intake and output, and blood pressure readings taken two or three times a day. Also monitor serum chemistry values, especially for sodium. The aim of maintaining fluid balance is to achieve a stable serum sodium concentration and a decrease in body weight by 0.5% to 1% a day.

If the child has oliguria, limit fluid intake, including parenteral nutrition, to replacement of insensible fluid loss (excreted by the lungs, skin, and gastrointestinal tract) which is about one third the daily maintenance requirements in afebrile children. If the child is febrile, fluid administration is increased by 12% for each centigrade degree of temperature elevation. The child with **renal insufficiency** (i.e., as the kidneys' ability to conserve sodium and concentrate the urine decreases) is at greater risk for fluid loss with illness. In cases of acute gastrointestinal illness, children are at greater risk for dehydration.

Administer Medications

Because the kidney's ability to excrete drugs is impaired in ARF, dosages of all medications should be adjusted. The actual dosage of the drug can be reduced or the time interval between doses may be increased. Check drug levels to monitor for drug toxicity. Know the signs of drug toxicity for each medication the child is receiving.

Meet Nutritional Needs

Children are at risk for malnutrition because of their high metabolic rate during ARF. Parenteral or enteral feeding may be used initially to minimize protein catabolism. The diet is tailored to the individual child's need for calories, carbohydrates, fats, and amino acids or protein hydrolysates. Depending on the degree of renal failure, sodium, potassium, and phosphorus may be restricted. Initiate oral feeding as soon as the child can tolerate it.

Prevent Infection

The child with ARF is extremely susceptible to nosocomial infections because of altered nutritional status, compromised immunity, and numerous invasive procedures. Thorough handwashing and standard precautions are imperative to decrease the risk of infection. Use sterile technique for all invasive procedures and when caring for lines. Drainage from catheter sites should be cultured to check

for the presence of infectious organisms. Assess vital signs and lung sounds frequently.

Provide Emotional Support

The sudden onset of ARF presents parents with an unexpected threat to their child's life. Both the child and the parents experience anxiety because of the unexpected hospitalization and the uncertainty of the prognosis. Parents often feel guilty, regardless of the cause of renal failure. This guilt is intensified when renal failure is a result of dehydration or poisoning. Encourage parents to verbalize their fears and help them work through feelings of guilt. Explain procedures and treatment measures to decrease anxiety. Encouraging parents and older siblings to participate in the child's care can increase their sense of control.

Discharge Planning and Home Care Teaching

Encourage parental involvement early in the child's hospitalization. Be sure parents understand the importance of administering medications correctly. Teach family members proper technique for measuring blood pressure so they can monitor the child's hypertension, if ordered. Make sure the parents can identify signs of progressive renal failure (see the following chronic renal failure discussion).

Diet counseling is a key component of discharge planning and is usually performed by a renal dietitian. Depending on the degree of renal failure, the child's diet may include restrictions on protein, water, sodium, potassium, and phosphorus. The parents should be given written guidelines listing appropriate food choices to assist in menu planning. Ethnic and cultural preferences should be considered in listing menu options.

DEVELOPING CULTURAL COMPETENCE

REDUCING SODIUM IN THE CHILD'S DIET

Special effort is often needed to reduce the sodium in the diet of an Asian child. Sauces and seasonings for foods (soy sauce, mustards, monosodium glutamate, and garlic salt) are sodium rich even though the foods seasoned (rice, vegetables, shrimp, and chicken) are low in sodium. The child may ingest up to 18 grams of sodium a day with these added sauces and seasonings; 4 grams per day is the goal. The typical Mexican diet, high in sodium and potassium (avocados, tomatoes, beans), may also require significant modification. Individualized counseling and motivation are needed to encourage families to reduce the child's sodium intake and to use spices low in sodium when preparing meals.

Continued monitoring of renal function during follow-up examinations is critical as deterioration may occur over time. Referral to support groups can be helpful for both parents and children. The National Kidney Foundation is a source of numerous publications.

EVALUATION

Expected outcomes of nursing care include:

- The child's fluid status is balanced with edema-associated weight loss. Electrolyte and acid-base balance is restored.
- Nutritional needs are met.
- The child acquires no secondary infections.

CHRONIC RENAL FAILURE

Chronic renal failure (CRF) is a progressive, irreversible reduction in kidney function. The prevalence of CRF is approximately 18 per 1 million children (Vogt & Avner, 2004). Blacks have a higher rate of end-stage renal disease than whites by a ratio of 2.7:1 (Balinsky, 2000).

ETIOLOGY AND PATHOPHYSIOLOGY

In children, CRF usually results from developmental abnormalities of the kidney or obstructed urine flow and reflux, hereditary diseases such as polycystic kidney disease, infections such as hemolytic-uremic syndrome, and glomerulonephritis. (See discussions later in the chapter.)

The gradual, progressive loss of functioning nephrons ultimately results in **end-stage renal disease (ESRD)**. ESRD is characterized by minimal renal function (less than 10% of normal), uremic syndrome, anemia, and abnormal blood values. In ESRD, the kidneys can no longer maintain homeostasis and the child requires dialysis.

The kidneys excrete excess acid in the body and regulate the body's fluid and electrolyte balance. Renal failure disrupts this fluid and electrolyte balance. As renal failure progresses, metabolic acidosis occurs because the kidneys cannot excrete the acids that build up in the body. Retention of excessive sodium and water is a common cause of the elevated blood pressure associated with CRF. Insufficient calcium loss, phosphorus retention, and elevated parathyroid hormone levels lead to renal osteodystrophy. Osteodystrophy increases the child's risk for spontaneous fractures and rickets. Growth retardation is caused by disturbances in the metabolism of calcium, phosphorus, and vitamin D; decreased caloric intake; and metabolic acidosis. The kidneys also produce erythropoietin (the growth factor responsible for the production and maturation of red cells); lack of erythropoietin and progressive renal disease are the underlying causes of the anemia of CRF.

CLINICAL MANIFESTATIONS

Children with CRF frequently have no symptoms initially. Early renal failure with glomerular filtration rate (GFR) of 50% to 75% of normal has few or no clinical signs. As pro-

gression continues, renal insufficiency occurs with polyuria as the kidneys cannot concentrate the urine. Symptoms become more classic as CRF occurs with pallor, headache, nausea, and fatigue. Decreased mental alertness and ability to concentrate may be seen. The child may have anemia leading to tachycardia, tachypnea, and dyspnea on exertion. As the disease progresses, the child loses his or her appetite and has complications of renal impairment, including hypertension, pulmonary edema, growth retardation, osteodystrophy, delayed fine and gross motor development, and delayed sexual maturation. See the contrast with signs of acute renal failure on page 1645.

In ESRD, the most advanced form of CRF, renal failure adversely affects all body systems. As the severity of the clinical and biochemical disturbances resulting from progressive renal deterioration increases, uremic symptoms develop. Signs and symptoms of uremic syndrome include nausea and vomiting, progressive anemia, anorexia, dyspnea, malaise, uremic frost (urea crystals deposited on the skin), unpleasant (uremic) breath odor, headache, progressive confusion, tremors, pulmonary edema, and congestive heart failure.

CLINICAL THERAPY

Laboratory evaluation, including serum electrolytes, phosphate, BUN, and creatinine levels and pH, is used to confirm the diagnosis of CRF. An early morning urine sample is collected for culture, and to calculate the protein-to-creatinine ratio. The child's glomerular filtration rate is calculated from prediction equations using the serum creatinine level and the patient's height and gender. Imaging studies are performed to identify renal diseases that could be causing the renal failure. A renal biopsy may sometimes be performed.

CRF is irreversible. However, the course of the disease is variable. Some children progress quickly to renal failure, necessitating dialysis. Other children are managed with a combination of medication and diet therapy for some time before significant renal impairment occurs. Frequent modifications in the treatment plan are often necessary to address the child's changing status. The goals of treatment are to slow the progression of renal disease and to prevent complications.

Dietary management focuses on maximizing caloric intake for growth while limiting phosphorus, potassium, and sodium intake as needed to keep electrolytes in balance. Tube feedings or parenteral nutrition may be required to achieve optimal protein intake, especially in children under 1 year of age. When CRF is present, optimal intake of high-quality protein (meat, fish, poultry, and egg whites) for infants is 2 to 2.5 g/kg/day; for older children it is 1.5 to 2 g/kg/day. Vegetable oils, hard candy, sugar, honey, and jelly may be recommended to add calories to the child's diet.

Numerous medications are used to treat children with CRF. See Table 52-6.

TABLE 52-6 ❁ **Medications Commonly Used by Children with Chronic Renal Failure**

Medication	Action or Indication	Nursing Considerations
Vitamin and mineral supplement (Nephrocaps)	Add vitamins and minerals missing from heavily restricted diet	Only prescribed vitamins should be used, over-the-counter brands may contain elements that are harmful.
Phosphate binding agents: Calcium carbonate (Tums), calcium acetate (PhosLo), or sevelamer hydrochloride (Renagel)	Reduce absorption of phosphorus from the intestines	Ensure that phosphate binding agent is aluminum-free.
Calcitriol (Rocaltrol)	Replace the calcitriol that kidneys are no longer producing to keep calcium balance normal	Monitor serum calcium level. Ensure that calcium supplement is provided.
Epoetin alfa (Epogen, Procrit)	Stimulates bone marrow to produce red blood cells, treats anemia due to CRF	Given by IV or subcutaneous injection. Monitor blood pressure as hypertension is an adverse effect. Monitor hematocrit and serum ferritin level according to facility guidelines.
Iron supplementation	Treat iron deficiency when epoetin alfa is prescribed	May be administered orally or IV during hemodialysis.
Growth hormone (rhGH)	Used to stimulate growth in children with CRF	Record accurate height measurements at regular intervals.
Antihypertensive agents: Angiotensin-converting enzyme (ACE) inhibitor (enalapril, lisinopril) Loop diuretics	Used with proteinuric kidney disease as it slows the progression to ESRD Used when volume overload is present	Monitor renal function and electrolyte balance.

Children who progress to ESRD require renal replacement therapy. The timetable for dialysis or renal transplantation is different from that of adults; transplantation is the goal so the child has an optimal chance for a more normal childhood. Earlier initiation can prevent some complications of ESRD. In addition to the GFR, nonspecific signs such as uremic syndrome, poorly controlled hypertension, renal osteodystrophy, failure of head circumference measurement to increase normally, developmental delay, and poor growth are used in determining when to initiate therapy. (Refer to the “Renal Replacement Therapy” section in this chapter.) Infection is the most common morbidity in children receiving renal replacement therapy.

NURSING MANAGEMENT

NURSING ASSESSMENT AND DIAGNOSES

Nursing assessment focuses on identifying signs and symptoms of renal failure and associated complications, and assessing the psychosocial effects of renal failure on the child and family.

Physiologic Assessment

The initial and ongoing assessment of the child focuses on identifying complications of renal failure. Observe for

signs of hypertension, edema, poor growth and development, osteodystrophy, and anemia. Assess vital signs to help identify electrolyte alterations (see page 1645).

Psychosocial Assessment

As renal disease progresses, the number of stressors on the child and family increases. Denial and disbelief are commonly the first reactions. A thorough family assessment can help to identify particular needs of the child and family (see Appendix H ∞). The development of ESRD is particularly challenging during childhood adolescence because of differences in appearance and social, psychologic, and physical issues. Nonadherence with treatments can endanger the adolescent’s life.

Nursing diagnoses for the child with CRF are similar to those previously listed for ARF. Additional diagnoses might include the following:

- *Delayed Growth and Development* related to decreased protein and caloric intake and loss of protein in dialysate
- *Impaired Social Interaction* related to impaired immunity and hemodialysis schedule during school hours
- *Activity Intolerance* related to anemia and fatigue
- *Ineffective Therapeutic Regimen Management* related to complexity of care plan and economic difficulties

TABLE 52-7 ❁ **Nutritional Information for the Child with Kidney Disease**

Children with kidney disease have restricted diets, generally low in sodium, potassium, and phosphorus. A renal dietitian works with families of children with chronic renal failure to develop meal plans that fit a restricted diet. The nurse can help families remember that certain foods must be avoided or eaten in very small quantities by reviewing this table.

High-Sodium Content Foods	High-Potassium Content Foods	High-Phosphorus Content Foods
<p><i>Soups and sauces:</i> e.g., gravy, spaghetti and tomato sauce, barbeque sauce, steak sauce</p> <p><i>Processed lunchmeats:</i> e.g., bologna, ham, salami, hot dogs</p> <p><i>Smoked meat and fish:</i> bacon, chipped beef, corned beef, ham, lox</p> <p>Sauerkraut, pickles, and other pickled foods</p> <p><i>Seasonings:</i> horseradish, soy sauce, Worcestershire sauce, meat tenderizer, and monosodium glutamate (MSG)</p>	<p><i>Fruit:</i> apricots, avocados, bananas, citrus fruits, fresh pears, nectarines, dates, figs, canteloupe and other melons, prunes, and raisins</p> <p><i>Vegetables:</i> celery, dried beans, lima beans, potatoes, leafy greens, spinach, tomatoes, winter squash</p> <p><i>Whole grains:</i> especially those containing bran</p> <p>Sardines, clams</p> <p>Peanuts</p> <p><i>Dairy products:</i> milk, ice cream, pudding, yogurt</p> <p>Potassium-containing salt substitutes</p>	<p><i>Dairy products:</i> milk, cheese, yogurt, custard, pudding, ice cream</p> <p>Dried beans, peas</p> <p>Nuts, peanut butter</p> <p>Chocolate</p> <p>Dark cola</p> <p>Sausage, hot dog</p>

- *Disturbed Body Image* related to short stature and visible external catheter for dialysis

PLANNING AND IMPLEMENTATION

Hospital-Based Care

Children with CRF are usually hospitalized for one or more of the following reasons: initial diagnostic evaluation, dialysis treatment initiation, problems with the treatment plan, infection, or another problem. Nursing care for the hospitalized child with CRF focuses on monitoring for side effects of medications, preventing infection, meeting nutritional needs, and providing emotional support and anticipatory teaching.

Monitor for Side Effects of Medications

Watch for signs of electrolyte imbalance such as weakness, muscle cramps, dizziness, headache, and nausea and vomiting in children taking diuretics. Supervise the child's activities closely to prevent falls resulting from dizziness, especially at the beginning of diuretic therapy. If antihypertensive medications such as hydralazine are being administered, monitor the child's weight to detect excessive gain resulting from water and sodium retention.

Prevent Infection


The child with CRF is susceptible to infections. Be alert for signs of infection, such as elevated temperature; cloudy, strong-smelling urine; dysuria; changes in respiratory pattern; or productive cough. Emphasize to the child and family the importance of good handwashing practices. Make sure the child receives the 23-valent pneumococcal, and meningococcal vaccines in addition to usual childhood immunizations.

Meet Nutritional Needs

Maintaining adequate nutritional intake in a child with CRF who has dietary restrictions is challenging. Provide small, frequent feedings and present meals attractively to encourage the child to eat. A renal dietitian works with families of children with chronic renal failure to develop meal plans that fit a restricted diet. See Table 52-7 for foods that children with CRF should avoid.

Provide Emotional Support

Progressive CRF requires a total lifestyle change for the child and family. The parents and child need opportunities to express and work through their feelings related to the disease, prognosis, and treatment restrictions. Help children express their feelings through drawings or therapeutic play.

The need for ongoing dialysis treatments and the wait for a suitable donor kidney are stressful for both parents and child. Identify effective coping methods and family support systems to promote treatment compliance. The National Kidney Foundation and local support groups for kidney disease can give the family information or additional support. See the Companion Website for further information and links to these resources. 

Discharge Planning and Home Care Teaching

Parents need to understand the necessity of long-term treatments and follow-up care. Help the family develop a schedule for medication administration that fits with their routine. Emphasize the importance of consistency in administration times. Teach parents how to recognize medication side effects and complications.

Appropriate referrals are made to home care nursing agencies as indicated. Home care nurses teach the parents of the child receiving peritoneal dialysis to perform the

treatment and to identify complications, as well as provide necessary support and reassurance see page 1655.

Nursing Care in the Community

Children with CRF require frequent outpatient visits to monitor the progression of signs and symptoms, and to evaluate the effectiveness of current treatments. Blood and urine tests are performed to monitor renal function. Radiographs of the bones are often taken at 6-month intervals to assess changes caused by osteodystrophy.

When assessing the child, compare height, weight, and head circumference to age-specific norms to identify growth retardation and to plot progress. Assess developmental progress using the Denver II or another screening tool (see Chapter 37∞). Assess the adolescent for signs of delayed sexual maturation and, in girls, amenorrhea.

Promote good dentition and oral hygiene. Regular dental visits are important to reduce infections. Make sure the family understands the need for antibiotic prophylaxis before certain invasive procedures, including dental care (see Table 48–5 ∞). If possible, all immunizations should be provided before renal transplantation, as long-term immunosuppressive therapy will then be prescribed. Live vaccines should not be given to the child taking immunosuppressive agents.

Review any dietary restrictions with parents. Provide sample menus for meal planning to help parents incorporate dietary changes into daily meals. A renal dietitian usually helps the child make food selections and restrict fluids and sodium as necessary, taking into account the child's likes and dislikes and cultural background. High-caloric supplements may be needed because of anorexia. School-age children may not understand the consequences of nonadherence with dietary restrictions and may perceive these restrictions as punishment. Adolescents often resent the dietary restrictions and ongoing dialysis treatments, which pose a threat to their independence and evolving sense of self. Noncooperation, depression, and hostility are common responses. Discuss

possible behavioral responses to dietary restrictions and limitations imposed by the treatment plan.

Encourage parents to register the young child for the Early Intervention Program to promote development and interaction with other children. The dialysis schedule for school-age children should enable the child to participate in school.

School-age children and adolescents are often embarrassed about being seen as different from peers. Ask the child how he or she feels about the need to follow a special diet, take medications, and undergo dialysis treatments. To minimize the psychologic consequences of coping with a chronic disease, encourage parents to promote the child's participation in age-appropriate activities. Attendance at school and contacts with peers promote normal growth and development. Work to promote the child's self-worth and a healthy self-esteem. Encourage adolescents to participate in a program that helps them transition to adult health services and job skill training. Begin teaching the child during early adolescence about the health condition, medications taken and their actions, how to access emergency help, and problems caused by nonadherence to treatment. As the adolescent ages, have the family begin giving more responsibility for self-care, such as making appointments for healthcare, obtaining prescription refills, and seeking out adult healthcare professionals and a dialysis program.

Give the parents timely information about the disease process, dialysis treatments, and issues related to renal transplantation, as the child's renal impairment progresses.

EVALUATION

Expected outcomes of nursing care include:

- The child is fully immunized with childhood and additional vaccines.
- The child's fluid status is maintained.
- The child eats foods that meet nutritional needs while adhering to dietary restrictions.

COMPLEMENTARY CARE

AVOIDING HERBAL SUPPLEMENTS IN CHILDREN WITH CHRONIC RENAL FAILURE

Herbal supplements should not be used in children with CRF as they may contain harmful minerals, such as potassium. The body of a child with CRF is unable to clear waste products. There is also the risk for interaction between the herbs and medications taken that could place the child at risk for rejection of a transplanted kidney (National Kidney Foundation, 2004).

RENAL REPLACEMENT THERAPY

Renal replacement therapy is the treatment for renal failure and includes both dialysis and renal transplantation. In 2002, 6982 children between birth and 19 years of age received some form of renal replacement therapy. Hemodialysis has emerged as the dominant form of dialysis when treatment is initiated. By the 18th month of ESRD treatment, transplant is the dominant treatment method (United States Renal Data System, 2004).

EVIDENCE-BASED NURSING

LIVING WITH END-STAGE RENAL DISEASE

Clinical Question (Problem)

End-stage renal disease is a serious chronic condition that requires significant adaptations in lifestyle and complex medical treatments that take a toll on the child and family. What is the impact of the condition on adolescents?

Evidence

A study of 35 adolescents, aged 13 to 18 years, was conducted to evaluate their perceptions of themselves and living with end-stage renal disease. Twenty-one of the adolescents provided responses that clustered into one of four groups:

- Normalization, $n=8$ (identified selves as independent and leading as normal a life as possible)
- Illness causes a barrier to normalcy, $n=5$ (the physical effects of the disease such as shortened stature affected how they looked and how they were treated by society), had psychologic effects
- Illness management was parent focused, $n=5$ (adolescents wished to be independent but perceived that they were dependent upon parents to help care for them)
- Illness management was self-focused, $n=3$ (perceived that ongoing treatment for renal disease was very hard, and they perceived that they were different from their peers)

The study group of adolescents was 65.7% white and 28.6% African American. They were predominantly from intact families and 68.6% had positive treatment outcomes due to renal transplants (Snethen, Broome, Bartels et al., 2001).

Implications

Children and adolescents who develop end-stage renal disease are expected to develop adaptive functioning skills as well as cope with the consequences of the disease (physical trauma and operative scars, corticosteroid side effects, dietary restrictions, growth failure, and responses of peers). Parents must modify lifestyles and their hopes and dreams for their children's future. Strategies for managing the disease differ for every family. Normalization is a coping process in which the family views the care of the child with a chronic condition as a "normal" part of life, rather than an inconvenience or something outside of their routine. They choose to focus on the normal aspect of the child's life and the family's life. In cases when normalization cannot be achieved or sustained, the adolescent's condition may have recently changed or another family stressor is present. These families view their life and their child as different from other families because of the child's condition. Nurses can be effective in working with families by listening to the issues and offering suggestions. Often the opportunity to talk through the child's management plan will help the family consider different strategies that may be effective. The nurse may also provide linkages to community resources that may help the family.

Critical Thinking

Initiate a discussion with an adolescent with end-stage renal disease. Listen to the adolescent's description of living with the condition. Develop a nursing care plan to help the child take the next steps in self-management.

Reference

Snethen, J. A., Broome, M. E., Bartels, J., & Warady, B. A. (2001). Adolescent's perception of living with end-stage renal disease. *Pediatric Nursing*, 27(2), 159-167.

PERITONEAL DIALYSIS

In peritoneal dialysis the peritoneum of the abdomen is the membrane through which the body's waste products pass from the blood to the abdominal cavity. A catheter is inserted through the abdominal wall into the peritoneal cavity. The dialysis solution (**dialysate**) that enters the abdomen contains dextrose that pulls body wastes and extra fluid into the abdominal cavity. These wastes and extra fluid leave the body with the drained dialysate. This method of dialysis is beneficial to small children since it allows continuous removal of fluids and waste products, decreasing the toxic effects of waste products on the child's developing body. The child can ambulate and interact with the environment. Dietary and fluid restrictions are less severe. The timing of the treatment can be set to minimize the interruption of school, play, or other social events.

Two types of peritoneal dialysis are commonly used: continuous ambulatory peritoneal dialysis and automated peritoneal dialysis. Graduated cylinders are used to monitor the volume of fluid exchanged.

- Continuous ambulatory peritoneal dialysis (CAPD) uses gravity to instill prefilled bags of dialysate into the peritoneal cavity four or five times a day. The fluid remains in the cavity for 4 to 8 hours. An attached bag is folded under the child's clothes, permitting normal activity. After the allotted time, the dialysate is drained by hanging the bag lower than the pelvis. The repeated connections and disconnections with this method are time consuming for the child and family and increase the risk of infection.
- Automated peritoneal dialysis uses an automatic cycler to instill and drain the dialysate about five times over a 10-hour period, usually overnight. One additional exchange may be needed during the day. With this method the number of connections and disconnections is minimized, which reduces demands on the family as well as the risk of infection. This is the preferred peritoneal dialysis method since a more customized schedule can be developed to allow children to attend school (Verrina, Zacchello, Edefonti et al., 2001).

HEALTH PROMOTION

The Child with Chronic Renal Failure



Growth and Development Surveillance

- Compare the child's height, weight, and head circumference to age-specific norms to identify growth retardation and to plot progress.
- Assess developmental progress using the Denver II or another screening tool (refer to Chapter 37∞).
- Educate parents on normal developmental milestones and measures to promote achieving those milestones.
- Assess the adolescent for signs of delayed sexual maturation and, in girls, amenorrhea.

Nutrition

- Review the dietary restrictions with the child and parents.
- Partner with the family to assist the child to make food selections and to restrict fluids and sodium as necessary, taking into account the child's likes and dislikes and cultural background. Encourage the child and family to take a list of a few favorite foods to the dietitian to see if they can be integrated into the child's meal plan.
- Make meal time pleasant and make foods taste more appealing with permitted spices.
- Discuss possible behavioral responses by older children and adolescents to dietary restrictions and limitations imposed by the treatment plan. Involve the child and adolescent in discussions about dietary restrictions, and when possible integrate their recommendations for dietary restrictions and fluid management throughout the day.
- Emphasize to the school-age child that dietary and other restrictions are not punishment.
- Use enteral feeding at night to provide the needed calories for growth.
- Discuss a potential reward program that may be effective in motivating the child and adolescent to improve their nutritional habits and adherence to prescribed therapy (Ritz, 2002).

Physical Activity

- Encourage child to participate in developmentally appropriate activities as tolerated.

- Partner with the child to establish a routine plan for physical activity as tolerated that will help promote strong bones.

Oral Health

- Promote good dentition and oral hygiene.
- Schedule regular dental visits for examination and cleaning to reduce infections.
- Partner with the family to ensure they understand the need for antibiotic prophylaxis before certain invasive procedures, including dental care.

Mental and Spiritual Health

- Ask children how they feel about the need to follow a special diet, take medications, and undergo dialysis treatments. Ask what might make it easier for them to cope with the treatments, and integrate at least one idea into the care plan.
- Encourage parents to promote their child's participation in age-appropriate activities to minimize the psychologic consequences of coping with a chronic disease.
- Adolescents often resent the dietary restrictions and ongoing dialysis treatments, which pose a threat to their independence, evolving sense of self, and their need for independence. Noncooperation, depression, and hostility are common responses.
- In preparation for transitioning to adult healthcare, encourage adolescents to participate in a program that assists them with transition to adult health services and job skill training (Myers, 2002).

Relationships

- Attendance at school and contacts with peers promote normal growth and development.
- Work to promote the child's self-worth and a healthy self-esteem.
- Prepare the child for peer conflict.
- Ensure that parents understand the importance of encouraging normal socialization of their child.

Disease Prevention Strategies

- Partner with the child and family to establish plans to avoid large crowds, people with infections, or other risks that expose the child to infection.
- If possible, all immunizations should be provided before renal transplantation, as long-term immunosuppressive therapy will then be prescribed.
- Live vaccines should not be given to the child taking immunosuppressive agents.
- Encourage the family to maintain scheduled appointments for routine serum and urine diagnostic tests performed to monitor renal function.

TABLE 52-8 ❁ **Complications of Peritoneal Dialysis**

Complication	Cause
Peritonitis Cloudy dialysate, abdominal pain, tenderness, leukocytosis, fever (neonatal hypothermia), constipation	<i>Staphylococcus aureus</i> , <i>Staphylococcus epidermidis</i> , fungal infections, gram-negative rods (risk is proportional to duration of dialysis and inversely proportional to age)
Pain During inflow	Too rapid a rate of infusion, too large a volume of dialysate, encasement of catheter in a false passage, extremes in temperature of dialysate
During outflow at end of emptying	Omentum entering catheter at end of outflow
Leakage Fluid around catheter, edema of penis or scrotum secondary to leakage into abdominal subcutaneous tissue, fluid leakage to pleural spaces through diaphragm	Overfilling of abdomen, catheter that has migrated from peritoneal cavity
Respiratory symptoms Shortness of breath, decreased breath sounds in lower lobes, inadequate chest expansion	Abdominal fullness that compromises diaphragm movement, hole in diaphragm allowing dialysate into chest cavity

In children receiving peritoneal dialysis for ARF, a percutaneously placed catheter can be used for a few weeks. In children with CRF, a catheter is placed surgically for long-term use.

The primary complications of peritoneal dialysis are peritonitis and abdominal hernia (Table 52-8). Signs and symptoms of peritonitis associated with peritoneal dialysis include cloudy dialysate, fever, vomiting, diarrhea, abdominal pain, and tenderness. Chronic alterations in the peritoneal membrane transport capacity may result from peritonitis and may lead to peritoneal membrane failure (Warady, Schaefer, Holloway et al., 2000). Peritonitis is treated with antibiotics infused in the dialysate.

Teach the family to perform peritoneal dialysis and to use sterile technique when performing dialysis and when doing catheter care. Peritoneal dialysis is time consuming, and family members must be committed to managing this procedure daily. Help the family develop home routines that minimize disruptions to daily family life. For additional information, refer to “Nursing Care Plan: The Child Receiving Home Peritoneal Dialysis.”

HEMODIALYSIS

In hemodialysis the blood flows through a machine with a special filter that removes body wastes and extra fluids. Blood is pumped out of the body and through a dialyzer, where waste products and extra fluids diffuse out across a semipermeable membrane. Dialysate is pumped in the direction opposite blood flow to promote waste extraction.

Differences in osmolarity and concentration between the child’s blood and the dialysate alter the intravascular electrolyte concentration and reduce the intravascular volume. Hemodialysis is provided to children in the critical care setting and in a special center (Figure 52-6 ❁). Treatment is usually performed three times a week, with each session lasting approximately 3 to 4 hours. Continuous renal replacement therapy (CRRT) is a form of continuous hemodialysis used when the child has acute renal failure, multiple organ failure, and hemodynamic instability.

In emergency hemodialysis and for infants, a double-lumen cannula is inserted into a large vein (e.g., the femoral, jugular, or subclavian vein). Children over 20 kg (44 lb) often have an artificial blood vessel, an arteriovenous shunt or fistula, created. Two needles are inserted into the arteriovenous fistula, one to carry blood to the dialyzer and the other to return cleaned blood to the body.

Hemodialysis is more efficient than peritoneal dialysis but requires close monitoring for symptoms related to hypotension or rapid changes in fluid and electrolyte balance. Uncommonly, a *disequilibrium syndrome* (rapid changes in the body’s water and electrolyte balance during treatment) may occur during or soon after the dialysis procedure is initiated. Other complications include access thrombosis and infection. Heparin is used to achieve an active clotting time of 150%, which reduces the risk of thrombosis.

Nursing management focuses on care of the child during dialysis and teaching the child and family about the administration of heparin and the control of bleeding



NURSING CARE PLAN

THE CHILD RECEIVING HOME PERITONEAL DIALYSIS

Intervention	Rationale	Expected Outcome
1. Nursing Diagnosis: Imbalanced Nutrition: Less than Body Requirements related to poor appetite, feeling of fullness after a small amount, and loss of protein in dialysate		
NIC Priority Intervention: Nutrition management: Assistance with or provision of a balanced dietary intake of foods and fluids		NOC Suggested Outcome: Nutrition status: Food and fluid intake: Amount of food and fluid taken into the body over a 24-hour period
Goal: The child will obtain adequate nutrients each day.		
<ul style="list-style-type: none"> ■ With a nutritionist, develop a diet plan to identify the amounts of essential nutrients needed. ■ Provide small, frequent meals of needed nutrients. ■ Make mealtimes pleasant and avoid battles over the child's intake. ■ Provide supplements by tube feeding if adequate oral intake is not possible. 	<ul style="list-style-type: none"> ■ Parents need concrete guidelines for food preparation. ■ The child will feel full with smaller amounts of food because of the dialysate. ■ The child will be more inclined to eat if there is less stress. ■ Adequate nutrition is important for growth and development, and must be supported if oral intake is inadequate. 	The child's intake is adequate for an expected growth pattern to be maintained.
2. Nursing Diagnosis: Risk for Infection related to daily invasive procedure		
NIC Priority Intervention: Infection control: Minimizing the acquisition and transmission of infectious agents		NOC Suggested Outcome: Risk control: Actions to eliminate or reduce actual, personal, and modifiable health threats
Goal: The child will not develop peritonitis.		
<ul style="list-style-type: none"> ■ Wash hands, use sterile gloves and aseptic technique for connection and disconnection of catheters. ■ Perform daily catheter site care. 	<ul style="list-style-type: none"> ■ Aseptic technique reduces chance of introducing bacteria into the abdomen. ■ Skin around the catheter site will have fewer organisms that could potentially cause infection. 	The child does not develop peritonitis.
Goal: If peritonitis occurs, it will be treated appropriately.		
<ul style="list-style-type: none"> ■ Observe for signs of infection (fever, abdominal pain, cloudy dialysate). ■ Report signs of infection to physician immediately. 	<ul style="list-style-type: none"> ■ Early identification of infection will reduce complications. ■ Rapid intervention may reduce need for hospitalization. 	Hospitalization will not be needed for peritonitis due to early identification and prompt treatment.
3. Nursing Diagnosis: Caregiver Role Strain related to daily dialysis treatments		
NIC Priority Intervention: Caregiver support: Provision of necessary information, advocacy, and support to facilitate primary patient care by someone other than a healthcare professional		NOC Suggested Outcome: Caregiver performance: Direct care: Provision by family care provider of appropriate personal and healthcare for a family member or significant other
Goal: The family copes with daily demands for the child's dialysis treatments.		
<ul style="list-style-type: none"> ■ Discuss the importance of daily, consistent dialysis treatments for the child's overall health status. ■ Collaborate with the family to identify strategies that could reduce the impact of dialysis on the family's life. 	<ul style="list-style-type: none"> ■ If parents understand the need for consistent dialysis treatments, they are more likely to adhere to guidelines. ■ When the family participates in planning care, adherence is more likely. 	The family adheres to daily dialysis treatment guidelines.

NURSING CARE PLAN—continued		
THE CHILD RECEIVING HOME PERITONEAL DIALYSIS		
Intervention	Rationale	Expected Outcome
3. Nursing Diagnosis: Caregiver Role Strain related to daily dialysis treatments (continued)		
<ul style="list-style-type: none"> Refer the family to local support groups for emotional support, treatment strategies, and respite care. 	<ul style="list-style-type: none"> Support groups may help the family develop effective coping strategies. 	
4. Nursing Diagnosis: Disturbed Body Image related to small size and perception of being and looking different		
<p>NIC Priority Intervention:</p> <p>Body image enhancement: Improving a patient's conscious and unconscious perceptions and attitudes toward his/her body</p>		<p>NOC Suggested Outcome:</p> <p>Psychosocial adjustment: Life change: Psychosocial adaptation of an individual to a life change</p>
Goal: The child will develop a sense of self-worth and self-esteem.		
<ul style="list-style-type: none"> Identify and emphasize strengths the child has (e.g., interaction style, skills, or cognitive abilities) despite being smaller than peers. Assist the child and family to identify popular clothing styles that hide the protuberant abdomen, dialysate bag, and catheter. Increase the child's participation in self-care as appropriate for developmental age. Promote participation in safe activities with peers. Encourage the child to participate in support groups with other children receiving dialysis. 	<ul style="list-style-type: none"> Perception of personal strengths should increase self-esteem. Clothing that conforms to current styles, but still hides dialysate, will help the child feel less different from peers. Ability to perform self-care increases the child's sense of control. Social interaction with peers helps reinforce similarities with others. Interactions with other affected children provide a chance to express feelings and frustrations, and to develop successful coping strategies. 	The child effectively interacts with peers and participates in age-appropriate activities.
5. Nursing Diagnosis: Ineffective Health promotion related to chronic condition		
<p>NIC Priority Intervention:</p> <p>Health system guidance: Facilitating a patient's location and use of appropriate health services</p>		<p>NOC Suggested Outcome:</p> <p>Health-seeking behaviors: Actions to promote optimal wellness, recovery, and rehabilitation</p>
Goal: The child's routine health promotion visits will be integrated with the management of the chronic condition.		
<ul style="list-style-type: none"> If a renal specialty team is not conveniently located and providing general healthcare, make sure the child has a primary care provider working in collaboration with the renal team. Assess the child regularly for height growth, developmental progress, and signs that the chronic condition is being managed effectively. Provide immunizations as recommended for the child with a chronic condition. Provide anticipatory guidance related to safety, developmental progress, appropriate physical activities, and behavior management. 	<ul style="list-style-type: none"> A source of health promotion and acute minor illness care is important, especially if the family lives a distance from the tertiary care center. Routine assessments will allow potential complications to be identified earlier. Immunizations may reduce the risk of potentially life-threatening infections in a child at high risk. Information will help the family support the child's health status and promote development. 	The child is fully immunized at appropriate intervals and the family has a source of regular care in the community.

FIGURE 52-6



A



B

This child is undergoing hemodialysis. **A**, A surgically implanted vascular graft is being used here. One needle is placed in the arterialized end of the graft (red tubing), and one needle is placed in the venous end (blue tubing) for blood return. **B**, The child is able to draw or perform other quiet activities during dialysis treatment. Note that the child's blood pressure is monitored carefully throughout the treatment.


from minor trauma. Carefully monitor fluid balance in the child undergoing hemodialysis. Check vital signs and blood pressure every half hour. Monitor oral intake and urinary output every half hour when the child is on the dialysis equipment. Weigh the child before and after the dialysis to determine any fluid imbalances that must be adjusted in the next hemodialysis session.

THINKING CRITICALLY

THE CHILD ON HEMODIALYSIS

Terrell, who is now 5 years old, was born with posterior urethral valves, which caused damage to his kidneys. Despite undergoing surgery to correct the defect during infancy, his kidney function continued to deteriorate. End-stage renal disease was diagnosed 2 years ago, and dialysis treatment was initiated. Terrell requires a kidney transplant, but in the meantime he is being treated with hemodialysis. He visits the dialysis center three afternoons a week for treatments lasting approximately 3 to 4 hours. This schedule permits him to attend kindergarten classes in the morning.

At this visit Terrell has gained weight and is edematous. In talking with him, his primary nurse at the dialysis center discovers that Terrell has been drinking cokes and eating “junk food” at school. Terrell asks the nurse not to tell his mother because she will be mad, but that he just can't help eating and drinking what he isn't supposed to.

How does Terrell's growth and development level affect his adherence to the treatment regimen? What is the immediate intervention for the nurse to take with Terrell? What approach does the nurse take with discussing this nutritional issue with the family? 

NURSING PRACTICE

Monitor the child receiving hemodialysis for complications that can occur suddenly.

- Hypotension—sudden nausea and vomiting, abdominal cramping, tachycardia, and dizziness
- Rapid fluid and electrolyte exchange—muscle cramping, nausea and vomiting, and dizziness
- Dysequilibrium syndrome—restlessness, headache, nausea and vomiting, blurred vision, muscle twitching, and altered level of consciousness

Because fluid and dietary limitations (foods containing reduced potassium, sodium, and phosphorus) are needed more often with hemodialysis than with peritoneal dialysis, make sure the family knows how to plan and provide for the child's daily nutritional needs. Review ways to reduce the risk of infection, including the daily care of the catheter site. Encourage showering rather than tub baths. Activities such as swimming may be discouraged.

KIDNEY TRANSPLANTATION

Kidney transplantation provides the only alternative to long-term dialysis for children with ESRD. It can normalize physiology and may let children grow normally. Because delaying transplantation has adverse effects on growth and development, children are given some priority over adults awaiting transplantation. Blood type compatibility between

the donor and recipient is essential for a transplant to be successful. A human leukocyte antigen (HLA) system match also improves survival of the graft. A living relative donor kidney has a higher survival rate than a cadaver kidney. Children and their families are carefully screened prior to transplantation in an effort to identify problems that could lead to rejection of the kidney or infection that could be life threatening if the immune system is suppressed.

After transplantation, the child must take immunosuppressive medications such as corticosteroids, azathioprine, cyclosporine, and antilymphocyte antibodies to suppress rejection. Immunosuppression regimens use various combinations and sequences of these drugs to reduce the incidence of acute and chronic rejection. Signs of rejection include fever, increased BUN and serum creatinine levels, pain and tenderness over the abdomen, irritability, and weight gain.

Complications of immunosuppression therapy include opportunistic infection, lymphomas and skin cancer, and hypertension. Nonadherence to therapy is the primary cause of transplanted kidney loss (in 10% to 15% of pediatric kidney transplant recipients). Nonadherence is highest among families with instability, in adolescents, females, and in children with a previous kidney loss due to nonadherence (Griffin & Elkin, 2001). Adherence is higher in adolescents when their parents are knowledgeable and supportive, and when they promote the adolescent to become competent in self-care (Pool & Korus, 2002). Some primary kidney diseases, such as glomerulonephritis and hemolytic-uremic syndrome, can also recur in the transplanted kidney.

Nursing management includes teaching parents about the transplantation process before it occurs to help prepare them for the experience. Discuss all aspects of the child's care that will have an impact on the family's life, including follow-up appointments, medications, and general health promotion. Monitor adherence to immunosuppression treatment at each visit in an effort to identify issues early. Teach parents about the signs of acute rejection and infec-

tion, including when and how to notify the child's physician if immediate care is required.

POLYCYSTIC KIDNEY DISEASE

Polycystic kidney disease (PKD) is a genetic disorder that has autosomal recessive and autosomal dominant forms. Liver abnormalities are associated with both forms of the disease. The incidence of the autosomal recessive form is 1 per 20,000 live births, and it is most often detected in fetuses and infants (Guay-Woodford & Desmond, 2003). The autosomal dominant form is the most common inherited kidney disease, with a prevalence of 1 per 400 to 500 individuals. The autosomal dominant PKD results from mutations on the PKD1 locus on chromosome 16 and PKD2 on chromosome 4. The autosomal recessive gene (PKHD1) is located on chromosome 6 (National Kidney and Urologic Diseases Information Clearinghouse, 2004).

In PKD, cellular hyperplasia of the collecting ducts causes them to dilate. Fluid secreted into these ducts enables cyst sacs to form. Initially, cysts are usually less than 2 mm in size and do not obstruct urinary flow. As the child grows, however, the cysts become larger and fibrosis occurs. The cysts slowly replace much of the kidney's mass and reduce kidney function. Tubular atrophy may occur in some children, whereas others have minimal changes in renal function. PKD is associated with liver abnormalities that progress to fibrosis, portal hypertension, and biliary infection, becoming more severe with age.

Newborns with PKD may have enlarged kidneys, detected at birth. Those with the most severe form of the disease die shortly after birth of pulmonary hypoplasia. Clinical manifestations in infants with autosomal recessive PKD include Potter facies (low-set ears, small jaw, and a flattened nose). Hypertension develops early in infancy and is often severe. Infants may have expected urine output or oliguria. Polyuria and polydipsia develop with progressive renal insufficiency. Respiratory distress and feeding intolerance may develop from the enlarged kidneys. As uremia develops, infants and children develop renal osteodystrophy and progressive developmental delay and growth failure.

Sonogram or renal biopsy confirms the diagnosis. The disease is often diagnosed on prenatal ultrasound. Liver function tests are usually normal initially. A liver biopsy may also be performed. Other family members should be screened for subclinical cases of PKD.

Treatment is supportive. Medications such as diuretics are prescribed for hypertension. Fluid and electrolyte abnormalities are managed. Antibiotics treat urinary tract infection. Growth hormones may be used in some children to promote growth. Renal osteodystrophy is treated to suppress the parathyroid hormone. Many children develop

DEVELOPING CULTURAL COMPETENCE

RACE AND THE RENAL TRANSPLANT WAITING LIST

Access to the renal transplant waiting list differs depending on the patient's race. Black children are 12% less likely to be placed on the waiting list than whites at any point in time. It is unknown if these differences are due to physician bias in identifying transplant candidates, patient or family preference, or difference in the time to see a nephrologist (Furth, Garg, Neu et al., 2000).

ESRD by 10 years of age. Renal dialysis or a transplant prolong survival; however, liver problems may continue to complicate the child's health, even when the renal condition is well controlled. Up to 20% to 30% of children die by age 15 years (Davis & Avner, 2004).

NURSING MANAGEMENT

Nursing care is the same as that for the child with renal insufficiency and chronic renal failure. Observe the child for signs of progressive renal impairment. Make sure the family schedules follow-up appointments to assess growth, developmental progress, and the effectiveness of the treatment plan. Family teaching for home management focuses on medications, diet adequate in protein and calories to support growth, management of acute gastrointestinal illnesses, and care for the child with progressive renal insufficiency and a liver disorder. Since the disease is inherited, the family should be referred for genetic counseling.

HEMOLYTIC-UREMIC SYNDROME

Hemolytic-uremic syndrome (HUS) is an acute renal disease that is the most common cause of acute renal failure. HUS is an important cause of chronic renal failure. It occurs most often in children under age 4 years with a peak between 1 and 2 years. The syndrome has a classic triad of signs: (1) hemolytic anemia, (2) thrombocytopenia, and (3) ARF.

The development of HUS is often linked to enterohemorrhagic *Escherichia coli* strain 0157:H7, which produces a toxin that attaches to the glomeruli, collecting ducts, and distal tubules. Contaminated beef is the vector in more than half of cases. The toxin damages the lining of the glomerular arterioles, causing the endothelial cells to swell. In response, clotting mechanisms deposit fibrin in the renal arterioles and capillaries. This partial occlusion damages the red blood cells, resulting in hemolytic anemia. Platelets cluster in areas of vascular endothelial damage, causing thrombocytopenia. ARF develops from acute tubular necrosis as a consequence of blood clotting in the arterioles and the toxic effect of hemolyzed red blood cells on renal tubular cells. Autosomal recessive and autosomal dominant forms of HUS also exist, accounting for less than 5% of cases (Varade, 2000).

An episode of severe gastroenteritis with bloody diarrhea, upper respiratory infection, or UTI precedes the development of HUS by 1 to 2 weeks. Signs and symptoms of HUS include hemolytic anemia, hypertension, pallor and purpura, and neurologic involvement (irritability, seizures, altered level of consciousness, hallucinations, posturing, blindness), hematuria, proteinuria, oliguria or anuria, edema, and ascites. The child may also have hyperkalemia and metabolic acidosis as a result of renal failure. A peripheral blood smear with

fragments of red blood cells, fibrin fragments, and a decreased platelet count ($<140,000/\mu\text{L}[\text{mm}^3]$) confirms the diagnosis.

Treatment focuses on the complications of ARF and includes fluid restrictions and a high-calorie, high-carbohydrate diet that is low in protein, sodium, potassium, and phosphorus. Enteral nutrition is sometimes needed. The use of antibiotics is controversial. Medications may include calcium gluconate or calcium chloride, aluminum hydroxide gel to bind to phosphorus, Kayexalate to remove excess potassium, and antihypertensive agents. Treatment of diarrhea with antimotility medications is contraindicated because they increase the risk of progression from hemorrhagic colitis to HUS (Varade, 2000). Use of an oral toxin-binding agent was recently evaluated and found to have no benefit in children with diarrhea-associated HUS (Trachtman, Cnaan, Christen et al., 2003).

About 40% of children need dialysis, and approximately 3% to 5% of those affected will die (Trachtman et al., 2003). Peritoneal dialysis is preferred unless the child has severe colitis and abdominal tenderness. Some children may develop chronic renal failure. Transfusions of fresh packed red blood cells may be ordered to treat severe anemia. Platelets are given if the child is bleeding or if surgery is needed. Transfusions should be administered carefully to prevent hypertension caused by hypervolemia.

NURSING MANAGEMENT

Nursing care is the same as that for the child with ARF, described earlier. Careful monitoring of neurologic signs, laboratory values, fluid and electrolyte balance, and bleeding is essential. Monitor daily weights and assess intake and output. Assess the child for abdominal discomfort from diarrhea. Observe the child carefully for signs of progressive renal impairment. Discharge planning focuses on teaching parents about medications and dietary and fluid restrictions. Follow-up visits are necessary to evaluate the effectiveness of the treatment plan. Teach parents that HUS can be largely prevented by cooking of ground beef to 155°F throughout, meaning no more rare hamburgers. Teach them to wash hands carefully when handling raw ground meats, and to make sure utensils touching raw meat do not come into contact with cooked meats.

ACUTE POSTINFECTIONOUS GLOMERULONEPHRITIS

Glomerulonephritis is an inflammation of the glomeruli of the kidneys. In children, it is most often a response to a group A beta-hemolytic streptococcal infection of the skin or pharynx. It is also caused by other organisms, including *Staphylococcus*, *Pneumococcus*, and *Coxsackie* viruses. The incidence of acute postinfectious glomerulonephritis

(APIGN) is highest in children who are 2 to 12 years of age, and the disorder is more common in boys than in girls (Lang & Towers, 2001). Early antibiotic therapy for streptococcal infection does not seem to prevent the development of APIGN (Patel & Bissler, 2001).

ETIOLOGY AND PATHOPHYSIOLOGY

The child with APIGN usually becomes ill after recovering from a strain of group A beta-hemolytic streptococcal infection of the upper respiratory tract or the skin that subsequently attacks the kidney. Signs of APIGN develop after 8 to 14 days.

Glomerular damage occurs as a result of an immune complex reaction that localizes on the glomerular capillary wall. Antibody–antigen complexes become lodged in the glomeruli, leading to inflammation and obstruction. Capillaries in the glomeruli are obstructed by damaged tissue cells, and the glomerular filtration rate is reduced. Vascular permeability increases, allowing red blood cells and red cell casts to be excreted. Sodium and water are retained, expanding the intravascular and interstitial compartments and resulting in the characteristic finding of edema.

CLINICAL MANIFESTATIONS

Many children are asymptomatic. In other children the onset is usually abrupt with flank or midabdominal pain, irritability, malaise, and fever. Microscopic hematuria is present in nearly all cases, and gross hematuria, resulting in tea-colored urine, is found in up to 50% of cases. Mild periorbital edema occurs early, but edema may progress in severity to cause dyspnea, cough, ascites, crackles, and a gallop rhythm (Lang & Towers, 2001). Acute hypertension may cause an encephalopathy that includes headache, nausea, vomiting, irritability, lethargy, and seizures. Oliguria may or may not be present.

CLINICAL THERAPY

The serum BUN and creatinine concentrations are elevated. Serum protein is decreased due to mild or moderate proteinuria. The white blood cell count and erythrocyte sedimentation rate may be elevated, and serum lipid levels are increased in about 40% of cases. An elevated antistreptolysin O (ASO) titer reflects the presence of antibodies from a recent streptococcal respiratory infection, but the ASO level associated with a recent skin infection is low. The anti-DNAse B titer is helpful for detecting antibodies associated with recent skin infections. Up to 90% of children have reduced serum C3. Urinalysis reveals hematuria, proteinuria, and red and white cell casts. Anemia is common in the acute phase, usually because extracellular fluid dilutes the serum. The hemoglobin level and hematocrit value may decrease during the late phase as a result of hematuria.

Treatment focuses on relief of symptoms and supportive therapy. Bed rest is a key component of the treatment plan during the acute phase. Hypertension can be managed with a combination of an antihypertensive medication (such as hydralazine) and a diuretic (such as furosemide). Mild to moderate hypertension should be treated with fluid and salt restriction. A course of antibiotics may be given to ensure eradication of the original infectious agent. Immediate emergency care is needed for severe hypertension with cerebral dysfunction; diazoxide or hydralazine is administered intravenously.

Fluid requirements are determined by careful monitoring of urinary output, weight, blood pressure, and serum electrolytes. Initially, only insensible losses are replaced until the status of renal function is known. The severity of edema determines the degree of dietary restriction. Sodium and potassium intake are restricted. With severe azotemia, protein intake may have to be limited.

The prognosis for over 95% of children with APIGN is good. Most children recover completely within a few weeks. Recurrences are unusual. Approximately 2% of children progress to end-stage renal disease (Lang & Towers, 2001).

NURSING MANAGEMENT

NURSING ASSESSMENT AND DIAGNOSES

Assess edema, which may be periorbital or dependent and shifts as the child's position is changed. Assess for circulatory congestion (crackles, dyspnea, and cough). Monitor blood pressure, which can rise as high as 200/120 mm Hg. With severe hypertension, assess for signs of central nervous system problems (headache, blurred vision, vomiting, decreased level of consciousness, confusion, and convulsions).

Nursing diagnoses may include the following:

- *Excess Fluid Volume* related to decreased glomerular filtration and increased sodium retention
- *Risk for Infection* related to renal impairment and corticosteroid therapy
- *Risk for Impaired Skin Integrity* related to tissue edema
- *Imbalanced Nutrition: Less than Body Requirements* related to loss of appetite and proteinuria
- *Activity Intolerance* related to fluid and electrolyte imbalance, infectious process, and altered nutrition
- *Effective Therapeutic Regimen Management* related to child's medication schedule and treatment regimen after discharge

PLANNING AND IMPLEMENTATION

As with other renal disorders, care of the child with APIGN requires careful monitoring of vital signs and

fluid–electrolyte balance to evaluate renal functioning and identify complications. Bed rest is required during the acute phase. Nursing care focuses on monitoring fluid status, preventing infection, preventing skin breakdown, meeting nutritional needs, and providing emotional support to the child and family.

Monitor Fluid Status

Monitor vital signs, fluid and electrolyte status, and intake and output. Hypovolemia can occur as a result of fluid shifting from vascular to interstitial spaces despite the outward clinical signs of excess fluid retention. Monitor the degree of ascites by measuring abdominal girth. Document urine specific gravity. Make sure parents and visitors understand the need to limit fluids to prevent excessive intake.

Prevent Infection

Impaired renal function puts the child at risk for infection. Monitor for signs of infection, including fever, increased malaise, and an elevated white blood cell count. Instruct the family in good handwashing technique. Limit visitors, and screen for upper respiratory infections. Screen family members for the presence of streptococcal infection and refer for treatment if necessary.

Prevent Skin Breakdown

Dependent areas or areas prone to pressure are vulnerable to skin breakdown. Turn the child frequently. Pad bony prominences or susceptible areas with sheepskin, or protect skin with a transparent dressing. Make sure the child's bed is free of crumbs or sharp toys. Keep sheets tight and free of wrinkles.

Meet Nutritional Needs

A team approach (including the nurse, renal dietitian, parents, and child) is often needed to meet the child's nutritional needs. In most cases the child follows a “no added salt” and low-protein diet. Anorexia presents the greatest challenge to meeting daily nutritional requirements during the acute phase of the disease. To increase the child's appetite, encourage parents to bring the child's favorite foods from home, serve foods in age-appropriate quantities, and allow the child to eat with other children or with family members.

Provide Emotional Support

Parents of a child with APIGN commonly feel guilty. Parents may blame themselves for not responding more quickly to the child's initial symptoms or may believe they could have prevented the development of glomerular damage. Discuss the etiology of the disease and the child's treatment, and correct any misconceptions. Emphasize that APIGN develops in only a few children with streptococcal infection.

Discharge Planning and Home Care Teaching

Children are hospitalized for a few days, but it may take 3 weeks for hypertension and gross hematuria to resolve and longer for the disorder to resolve completely. Discharge planning focuses on teaching parents about the child's medication regimen, potential side effects of medications, dietary restrictions, and signs and symptoms of complications. Teach parents how to take the child's blood pressure and how to test urine for albumin, if ordered. Emphasize that it is important to avoid exposing the child to people with upper respiratory tract infections. Advise parents to allow the child to return to his or her normal routine and activities after discharge, with periods allowed for rest.

EVALUATION

Expected outcomes of nursing care are the following:

- The child receives appropriate fluid volume each day and maintains normal urine output of 0.5 to 1 mL/kg/hr.
- The child develops no areas of redness, abrasions, or skin breakdown over pressure points.
- The child's temperature remains within normal limits and the child is free of secondary infection.
- The child maintains preillness weight and tolerates daily intake that meets nutritional requirements.
- The parents administer medications as prescribed. The child's sodium and potassium levels reflect adherence to dietary restrictions.

STRUCTURAL DEFECTS OF THE REPRODUCTIVE SYSTEM

PHIMOSIS

In phimosis the foreskin over the glans penis cannot be pulled back, due to adhesions or infection. Circumcision, surgical removal of the foreskin, is often performed during the newborn period to prevent phimosis, for ease of proper male hygiene, and to prevent UTIs, balanitis (inflammation of the glans penis), and penile cancer (see Chapter 28 ∞). Betamethasone cream 0.05% applied twice daily for 4 to 8 weeks to the outer prepuce is an effective alternative to surgery (Ashfield, Nickel, Siemens et al., 2003).

CRYPTORCHIDISM

Cryptorchidism (undescended testes) occurs when one or both testes fail to descend through the inguinal canal into the scrotum. Normally, the testes descend during the seventh to ninth month of gestation.



Cryptorchidism may be the result of a testosterone deficiency, an absent or defective testis, or a structural problem such as a narrow inguinal canal, short spermatic cord, or adhesions. The disorder occurs in 3% of term male infants and in a higher rate of premature infants (Koo, 2001a). The higher temperature in the abdomen than in the scrotum results in morphologic changes to the testis that are apparent by 18 months of age. Lower sperm counts at sexual maturity may result (Koo, 2001b). Complications of uncorrected cryptorchidism include infertility, malignancy or torsion of the undescended testis, atrophy, and the psychologic effects of “empty” scrotum.

Cryptorchidism is usually detected during the newborn examination when palpation of the scrotum fails to reveal one or both testes. It is not unusual for boys with cryptorchidism to have an inguinal hernia as well. In a majority of cases, the testes descend spontaneously by 3 months of age. An undescended testis may be located in the inguinal canal, abdomen, perineum, or even the thigh. Ultrasound, CT scan, and MRI may be used to identify the location of the testes. A diagnostic laparoscope may also be needed to locate the testis. When neither testis can be palpated, hormonal or chromosomal evaluation may be performed to detect an intersex disorder.

An orchiopexy is performed at 1 year of age before further damage to the testes occurs. An incision is made at the location of the testis, either in the abdomen or in the inguinal area. Blood vessels are disentangled to allow the testis to reach into the lower scrotum. A second incision is made in the scrotum at the point where the testis is stitched to the inside wall to keep it in place. If the testis is defective or undeveloped, it may be removed surgically to decrease the risk of later malignancies and a prosthesis may be placed in the scrotum. The goals of surgery are repair of any hernia, enhanced fertility, and psychologic benefit. The orchiopexy also makes it easier to examine the testis for tumors. The risk of testicular cancer is 35 to 50 times greater in men with a history of cryptorchidism (Ferrer & McKenna, 2000).

NURSING MANAGEMENT

Preoperative nursing care includes preparing the parents and child for the procedure and addressing parents' concerns about the postsurgical outcome. Orchiopexy is often performed as an outpatient procedure. If the child is hospitalized, postoperative nursing care focuses on maintaining comfort and preventing infection. Encourage bed rest, and monitor voiding. Apply ice to the surgical area, and administer prescribed analgesics to relieve pain.

Discharge instructions should include demonstration of proper incision care. The diaper area should be cleaned well with each diaper change to decrease chances of infection. Teach parents to identify signs of infection such as redness, warmth, swelling, and discharge. Inform parents

to avoid straddling the infant across the hip and not to allow play on a riding toy for 2 weeks after surgery to promote healing and to prevent injury. Vigorous activity and rough play should also be avoided.

INGUINAL HERNIA AND HYDROCELE

An inguinal hernia is a painless inguinal or scrotal swelling of variable size that occurs when abdominal tissue such as bowel extends into the inguinal canal. A hydrocele is a fluid-filled mass in the scrotum. A hernia is found in 1% to 5% of term infants and up to 11% of preterm infants, more commonly in boys than girls (Burd & Burd, 2002).

During fetal development a peritoneal sac precedes the testicle's descent to the scrotum. The lower sac enfolds the testis to become the tunica vaginalis, and the upper sac atrophies before birth. Fluid may become trapped in the tunica vaginalis and cause the hydrocele. When the tunica vaginalis does not atrophy, an abdominal structure may move into it. In males the bowel is the most frequent tissue protruding into the groin, and in females an ovary or fallopian tube is a common finding (Katz, 2001).

Diagnosis is made by physical examination at birth or in early infancy. Palpation of the scrotum reveals a round, smooth, nontender mass. Transillumination helps determine whether the mass is a hernia or hydrocele (see Chapter 35 ∞). Parents may report an intermittent bulge in the groin or swelling in the scrotum. Swelling associated with a hernia may become more apparent with straining. Some hernias reduce in size during sleep.

Outpatient surgery is performed at an early age (usually after 3 months of age to reduce anesthesia risks) to avoid **incarceration** (hernia cannot be reduced and circulation is impaired), which is a medical emergency. A nerve block may be given in the operating room to reduce postoperative pain. The prognosis is generally excellent. Most hydroceles without inguinal hernia resolve spontaneously as the fluid reabsorbs by the time an infant is 1 to 2 years of age.

NURSING PRACTICE

Inguinal hernias can become incarcerated when a bit of bowel becomes trapped in the inguinal opening and the blood supply is constricted. The child has an acute onset of pain, abdominal distention, vomiting, and an irreducible mass. Other findings may include an edematous scrotum, poor feeding, and bloody stools (Burd & Burd, 2002). Efforts are made to reduce the hernia before surgery by placing the child in the Trendelenburg position and applying firm manual pressure on the affected side. The child needs surgery within 24 to 48 hours.

Nursing care for hydrocele and inguinal hernia includes explaining the disorder and its treatment and providing preoperative and postoperative teaching and care. Inform parents that the scrotum may be edematous and may appear bruised after surgery. Incision care involves careful cleaning of the diaper area. The incision is covered with a protective sealant rather than a dressing. Acetaminophen is provided for pain.

TESTICULAR TORSION

Testicular torsion is an emergency condition in which the testis suddenly rotates on its spermatic cord, cutting off its blood supply. The arteries and veins in the spermatic cord become twisted and interrupt the blood supply, leading to vascular engorgement and ischemia. Testicular torsion occurs in approximately 1 in 4000 males before 25 years of age, with the highest incidence at puberty (Sessions, Rabinowitz, Hulbert, et al., 2003; McAndrew, Pemberton, Kikiros, et al., 2002). Often the testicles are positioned horizontally in the scrotum, a congenital anomaly known as a bell clapper deformity, which predisposes the boy to this condition.

Manifestations include severe pain and erythema in the scrotum, nausea and vomiting, abdominal pain, and scrotal swelling that is not relieved by rest or scrotal support. The testes are tender on palpation and become edematous. The cremasteric reflex is absent. Symptoms generally start when the child is sleeping or inactive, but they can occur after

trauma, sexual activity, or exercise. The testis is positioned higher in the scrotum than the unaffected testis because of the shortened vascular pedicle. A testicular scan or Doppler flow sonogram may be performed if immediately available; however, risk for delay in treatment and misdiagnosis with these procedures is possible (McAndrew et al., 2002).

Torsion must be reduced within 4 to 6 hours to save the testis. Manual reduction with an analgesic is sometimes attempted, but emergency surgery is more common. During surgery (orchipexy), the testis is untwisted and stitched to the side of the scrotum in the correct position. The procedure is usually performed bilaterally to prevent future torsion in the other testis.

Nursing management involves psychologic support for the child and family related to the need for emergency surgery and concern about the child's future fertility. Reassure parents that as only one testis is usually involved, fertility should not be affected. The child often goes home within a few hours of surgery; thus the child and family need to be taught about proper care of the incision and pain management. Explain to parents that the child should not lift heavy objects for 4 weeks or participate in strenuous activity for 2 weeks after surgery to promote healing. Teach the adolescent testicular self-examination.

See Chapter 5 for information on sexually transmitted infections. ∞

Critical Concept Review

LEARNING OBJECTIVES

Describe the pathophysiologic processes associated with genitourinary disorders in the pediatric population.

Discuss the nursing management of a child with a structural defect of the genitourinary system.

CONCEPTS

Genitourinary disorders in the pediatric population are usually caused by:

1. Incomplete organ development during fetal development.
2. Hydronephrosis.
3. Improper placement of ureters in bladder and urethra in penis.
4. Anatomic obstruction or incomplete nerve innervation.
5. Infections.
6. Genetic Disorders.

Nursing care focuses on:

1. Preventing infection and trauma:
 - Protection of exposed surfaces prior to surgery.
 - Maintenance of proper alignment and immobility after surgery.
2. Protecting surgical site from injury
3. Monitoring renal function:
 - Strict intake and output.
4. Providing pain management and comfort measures to infant.

LEARNING OBJECTIVES

CONCEPTS

Discuss the nursing management of a child with a structural defect of the genitourinary system—continued

5. Providing emotional support to parents:
 - Encourage parent-infant bonding.
 - Instruct in discharge care.
 - Emphasize need for follow-up care.
 - Instruct parents in signs and symptoms of complications.
6. Educating parents to care for child after surgery.

Develop a nursing care plan for the child with a urinary tract infection.

- A nursing care plan for a child with a UTI includes:
1. Obtain a sterile urine specimen.
 2. Begin and maintain antibiotic therapy.
 3. Reinforce proper cleansing methods for girls (front to back).
 4. Medicate child for fever and discomfort.
 5. Reinforce need for completion of antibiotic treatment and follow-up urine specimen.

Describe the growth and developmental issues for the child with chronic renal failure.

1. Growth retardation.
2. Decreased mental alertness and ability to concentrate.
3. Fatigue.
4. Dyspnea on exertion.
5. Delayed fine and gross motor development.
6. Delayed sexual maturation.

Outline a plan to meet the fluid and dietary restrictions of a child with a renal disorder.

1. Restricted fluid needs:
 - Make a visual display giving child exact amount of fluid allowed.
 - Help child choose fluids high in calories and low in sodium.
 - Separate fluids from meals.
2. Restricted dietary needs:
 - Provide small, frequent feedings in a social atmosphere.
 - Use high-calorie supplements.
 - Instruct child and family on foods to avoid that are high in sodium, potassium, and phosphorus.
 - Refer to renal dietician.

Develop a nursing care plan for the child with acute and chronic renal failure on dialysis.

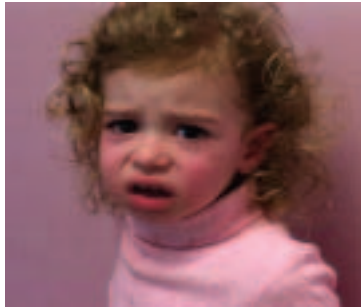
- Hemodialysis
1. Weigh child before and after dialysis.
 2. Monitor fluid balance during therapy.
 3. Check vital signs every half hour.
 4. Monitor for any signs of bleeding from dialysis catheter.
 5. Monitor PO intake and urinary output every half hour.
 6. Provide distractions for child during therapy.
- Peritoneal dialysis
1. Teach family to perform peritoneal dialysis using sterile technique to connect and disconnect bags of dialysate.
 2. Suggest clothing to help hide dialysate bags.
 3. Educate parents about signs of peritonitis.

List psychosocial issues for children of different ages who have surgery on the genitourinary system

1. Preschool and school-age child:
 - Embarrassment due to lack of continence.
2. School-age child and adolescent:
 - Embarrassment due to need for medications and doctor's visits.
 - Development of self-esteem and self-confidence with sexual identity and function.

CRITICAL THINKING IN ACTION

View the **Critical Thinking in Action** video in Chapter 52 of the CD-ROM. Then, answer the questions that follow.



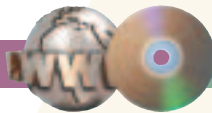
Kendra, a 2-year-old who appears ill, is brought into the urgent care center for a skin rash, fever, irritability, and edema. Her father is concerned she might also be dehydrated because she has had a decreased urine output. The doctor determines her skin rash does not blanch when pressure is applied and notes

a purplish color. Last week Kendra was treated for an episode of abdominal pain, diarrhea, and vomiting. The doctor immediately admits her to the hospital and orders a urine culture, blood work, and stool tests. The stool comes back positive for the strain of *E Coli* usually found in contaminated hamburger meat. Kendra has Hemolytic Uremic Syndrome (HUS) and is in acute renal failure (ARF). She also has a low hemoglobin, elevated BUN and creatinine, hematuria, and electrolyte imbalances.

Kendra is given medication for her electrolyte imbalances, antihypertensive medications, and is placed on a high-calorie, high-carbohydrate diet with restrictions on protein, sodium, potassium, and phosphorus. You explain to her parents the extreme importance of adhering to her dietary and fluid restrictions to help keep her electrolytes and fluid level balanced. You educate them that in some cases children with HUS need dialysis and some children have long term kidney damage. You teach them how to take her blood pressure, and how to observe for edema so that Kendra can be monitored after she goes home.

1. How is drug administration adjusted for Kendra since she has ARF? What is an important nursing role when administering various medications to her?
2. What is the reason ARF develops in HUS?
3. What is one way Kendra's condition could have been prevented?
4. Renal failure is characterized by azotemia and oliguria. Describe what these are.

MEDIA LINK



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- NCLEX-RN® Review, case studies, and other interactive resources for this chapter can be found on the Companion Website at <http://www.prenhall.com/london>. Click on "Chapter 52" and select the activities for this chapter.



- For animations, more NCLEX-RN® Review questions, and an audio glossary, access the accompanying CD-ROM in this textbook.

REFERENCES

- Ashfield, J. E., Nickel, K. R., Siemens, D. R., MacNeily, A. E., & Nickel, J. C. (2003). Treating phimosis with topical steroids in 194 children. *Journal of Urology*, 169(3), 1106–1108.
- Balinsky, W. (2000). Pediatric end-stage renal disease: Incidence, management, and prevention. *Journal of Pediatric Health Care*, 14(6), 304–308.
- Brooks, L. J., & Topol, H. I. (2003). Enuresis in children with sleep apnea. *Journal of Pediatrics*, 142(5), 515–518.
- Burd, A. J., & Burd, R. S. (2002). Inguinal hernia in the premature infant: Management of a common problem. *Neonatal Network*, 21(7), 39–47.
- Davis, I. D., & Avner, E. D. (2004). Anatomic abnormalities associated with hematuria. In R. E. Behrman, R. M. Kliegman, & H. B. Jenson, *Nelson textbook of pediatrics* (17th ed., pp. 1749–1750). Philadelphia: Saunders.
- Ferrer, F. A., & McKenna, P. H. (2000). Current approaches to the undescended testicle. *Contemporary Pediatrics*, 17(1), 106–111.
- Furth, S. L., Garg, P. P., Neu, A. M., Hwang, W., Fivush, B. A., & Powe, N. R. (2000). Racial differences in access to the kidney transplant waiting list for children and adolescents with end-stage renal disease. *Pediatrics*, 106(4), 756–761.
- Goodyer, P., & Kashtan, C. (1998). The genetic basis of pediatric renal disease. *Seminars in Nephrology*, 18(3), 244–255.
- Griffin, K. J., & Elkin, T. D. (2001). Non-adherence in pediatric transplantation: A review of the existing literature. *Pediatric Transplantation*, 5, 246–249.
- Guay-Woodford, L.M., & Desmond, R. A. (2003). Autosomal recessive polycystic kidney disease: The clinical experience in North America. *Pediatrics*, 111(5), 1072–1080.
- Hanson, K. A. (2003). Diagnostic tests and tools in the evaluation of urologic disease, Part II. *Urologic Nursing*, 23(6), 405–415.

- Hogg, R. J., Furth, S., Lemley, K. V., Portman, R., Schwartz, G. J., et al. (2003). National Kidney Foundation's kidney disease outcomes quality initiative clinical practice guidelines for chronic kidney disease in children and adolescents: Evaluation, classification, and stratification. *Pediatrics*, *111*(6), 1416–1421.
- Hogg, R. J., Portman, R. J., Milliner, D., Lemley, K. V., Eddy, A., & Ingelfinger, J. (2000). Evaluation and management of proteinuria and nephrotic syndrome in children: Recommendation from a pediatric nephrology panel established at the National Kidney Foundation Conference on Proteinuria, Albuminuria, Risk, Assessment, Detection, and Elimination (PARADE). *Pediatrics*, *105*(6), 1242–1249.
- Huether, S. E. (2002). Alterations of renal and urinary tract function in children. In K. L. McCance & S. E. Huether, *Pathophysiology: The biologic basis for disease in adults and children* (4th ed., pp. 1217–1230). St. Louis, MO: Mosby.
- Issenman, R. M., Filmer, R. B., & Gorski, P. A. (1999). A review of bowel and bladder control development in children: How gastrointestinal and urologic conditions relate to problems in toilet training. *Pediatrics*, *103*(6), 1346–1352.
- Jalkut, M. W., Lerman, S. E., & Churchill, B. M. (2001). Enuresis. *Pediatric Clinics of North America*, *48*(6), 1461–1488.
- Katz, D.A. (2001). Evaluation and management of inguinal and umbilical hernias. *Pediatric Annals*, *30*(12), 729–735.
- Koo, H.P. (2001a). Is it really cryptorchidism? *Contemporary Urology*, *13*(1), 12–16, 31.
- Koo, H.P. (2001b). Management of undescended testes. *Contemporary Urology*, *13*(3), 20–26.
- Kraus, S. J. (2001). Genitourinary imaging in children. *Pediatric Clinics of North America*, *48*(6), 1381–1423.
- Lang, M. M., & Towers, C. (2001). Identifying poststreptococcal glomerulonephritis. *Nurse Practitioner*, *26*(8), 34–49.
- Mahant, S., To, T., & Friedman, J. (2001). Timing of voiding cystourethrogram in the investigation of urinary tract infections in children. *Journal of Pediatrics*, *139*(4), 568–571.
- McAndrew, H. F., Pemberton, R., Kikiros, C. S., & Gollow, I. (2002). The incidence and investigation of acute scrotal problems in children. *Pediatric Surgery International*, *18*, 435–437.
- Mercer, R. (2003). Dry at night: Treating nocturnal enuresis. *Advance for Nurse Practitioners*, *11*(2), 26–32.
- Myers, P. S. (2002). Transitioning an adolescent dialysis patient to adult health care. *Nephrology Nursing Journal*, *29*(4), 375–376.
- National Kidney and Urological Diseases Information Clearinghouse. (2003). *Urinary tract infections in children* (NIH Publication No. 04-4246). Retrieved December 13, 2004, from <http://www.kidney.niddk.nih.gov/kudiseases/pubs/utichildren/index.htm>
- National Kidney and Urological Diseases Information Clearinghouse. (2004). *Polycystic kidney disease* (NIH Publication No. 05-4008). Retrieved December 19, 2004, from <http://www.kidney.niddk.nih.gov/kudiseases/pubs/polycystic/index.htm>
- National Kidney Foundation. (2004). *Use of herbal supplements in chronic kidney disease*. Retrieved December 23, 2004, from <http://www.kidney.org/atoz/atozPrint.cfm?id=123>
- Patel, H. P., & Bissler, J. J. (2001). Hematuria in children. *Pediatric Clinics of North America*, *48*(6), 1519–1537.
- Pool, R., & Korus, M. (2002). Pediatric kidney transplantation: Growth, development, and nursing implications. *Progress in Transplantation*, *12*(2), 129–135.
- Ritz, S. (2002). Pediatric hemodialysis and peritoneal dialysis: Report rewards program. *Journal of Renal Nutrition*, *12*(3), 199–204.
- Robinson, R. F., Nahata, M. C., Mahan, J. D., & Batsky, D. L. (2003). Management of nephrotic syndrome in children. *Pharmacotherapy*, *23*(8), 1021–1036.
- Sessions, A. E., Rabinowitz, R., Hulbert, W. C., Goldstein, M. M., & Mevorach, R. A. (2003). Testicular torsion: Direction, degree, duration, and disinformation. *Journal of Urology*, *169*(2), 663–665.
- Shaw, K. N., & Gorelick, M. H. (1999). Urinary tract infection in the pediatric patient. *Pediatric Clinics of North America*, *46*(6), 1111–1123.
- Snethen, J. A., Broome, M. E., Bartels, J., & Warady, B. A. (2001). Adolescent's perception of living with end-stage renal disease. *Pediatric Nursing*, *27*(2), 159–167.
- Sponseller, P. D., Jani, M. M., Jeffs, R. D., & Gearhart, J. P. (2001). Anterior innominate osteotomy in repair of bladder exstrophy. *Journal of Bone and Joint Surgery*, *83*(A-2), 184–193.
- Stokowski, L. A. (2004). Hypospadias in the neonate. *Advances in Neonatal Care*, *4*(4), 206–215.
- Tobias, N. E. (2000). Management of nocturnal enuresis. *Nursing Clinics of North America*, *35*(1), 37–60.
- Trachtman, H., Cnaan, A., Christen, E., Gibbs, K., Zhao, S., Acheson, D. W. et al. (2003). Effect of an oral Shiga toxin-binding agent on diarrhea-associated hemolytic uremic syndrome in children. *Journal of the American Medical Association*, *290*(10), 1337–1344.
- United States Renal Data System. (2004). *2004 Annual data report*. Retrieved December 13, 2004, from <http://www.usrds.org/atlas.htm>
- Varade, W. S. (2000). Hemolytic uremic syndrome: Reducing the risks. *Contemporary Pediatrics*, *17*(9), 54–64.
- Verrina, E., Zacchello, G., Edefonti, A., Sorino, P., Rinaldi, S., et al. (2001). A multicenter survey on automated peritoneal dialysis prescription in children. *Advances in Peritoneal Dialysis*, *17*, 264–268.
- Vogt, B. A. (2002). A newborn with a urinary tract anomaly: What role for the general pediatrician? *Contemporary Pediatrics*, *19*(10), 131–153.
- Vogt, B. A., & Avner, E. D. (2004). Renal failure. In R. E. Behrman, R. M. Kliegman, & H. B. Jenson, *Nelson textbook of pediatrics* (17th ed., pp. 1767–1775). Philadelphia: Saunders.
- Warady, B. A., Schaefer, F., Holloway, M., Alexander, S., Kandert, M., et al. (2000). Consensus guidelines for the treatment of peritonitis in pediatric patients receiving peritoneal dialysis. *Peritoneal Dialysis International*, *20*(6), 610–624.
- Williams, G., Lee, A., & Craig, J. (2001). Antibiotics for the prevention of urinary tract infections in children: A systematic review of randomized control trials. *Journal of Pediatrics*, *138*(6), 868–874.