Percutaneous techniques offer several advantages over open surgery in the treatment of many pediatric genitourinary diseases. The pediatric interventionalist routinely treats patients with conscious sedation on an outpatient basis that would require general anesthesia and lengthy hospital admissions if treated surgically. The minimally invasive nature of percutaneous therapy also results in cost reduction. The outcomes of percutaneous techniques have now been established as equal to or better than the corresponding surgical technique in many instances. In spite of this, pediatric genitourinary intervention has grown relatively slowly over the past decade. Limited growth in this area is likely due to a variety of factors, especially the preference of urologists to perform combined percutaneous and surgical procedures in the operating room. Most referrals to pediatric interventional radiologists are cases that are difficult to treat operatively or with endoscopic techniques. Consequently, a minority of children is referred for routine procedures.

Percutaneous treatment of diseases affecting the urinary tract most often begins with accessing a collecting system and placing a nephrostomy tube. Thus, nephrostomy insertion is the basic technique upon which percutaneous surgical procedures are built. This chapter discusses nephrostomy tube insertion, ureteral stent insertion, ureteral stricture dilatation, nephrostomy tract dilatation, percutaneous removal of calculi, endopyelotomy techniques used in the treatment of UPJ strictures and percutaneous renal angioplasty for treatment of renovascular hypertension.

26.2 Percutaneous Nephrostomy

Nephrostomy insertion is the building block for most urinary tract interventions. The percutaneous nephrostomy technique was first described for the treatment of hydronephrosis (Goodwin et al. 1955). About 20 years later, the first percutaneous stone removal was performed (Fernstrom and Johansson 1976). Endourologic technology was
further extended when electrosurgical instruments were safely used. These developments, combined with new interventional and endoscopic equipment, have led to the development of complex endourologic techniques. These advances have led to better patient care and a closer working relationship among the nephrologist, urologist, pediatric surgeon, transplant surgeon, and pediatric interventionalist. In many instances, these collaborations have led to a reduced need for open surgical procedures.

Percutaneous nephrostomy has been successful in over 97% of pediatric patients ranging in age from 1 day to 18 years (Irving et al. 1987; Winfield et al. 1984; LiPuma et al. 1984). These results compare favorably with surgical management (Gonzalez-Serva et al. 1977).

The most common indications for percutaneous nephrostomy is for relief of symptomatic urinary tract obstruction (Fig. 26.1) and pyonephrosis (Man et al. 1983; Pode et al. 1982). In a series of 50 percutaneous nephrostomies in the pediatric population reported by Stanley and colleagues (1983), the most frequent causes of obstruction were ureteropelvic junction (UPJ) narrowing and obstruction after ureteral reimplantation.

The benefits of percutaneous nephrostomy are related to the ease of placement under sedation and to the rapid relief of obstruction and improved renal function. Infected and obstructed systems can be drained, and fever management becomes possible (Gonzalez-Serva et al. 1977). Other indications for percutaneous nephrostomy include assessment of renal function, demonstration of pathologic anatomy, and differentiation between obstructed and nonobstructed dilated systems using a pressure flow study (Whitaker perfusion test) (Fig. 26.2) (Whitaker 1981).

Percutaneous nephrostomy can be utilized as a temporizing measure prior to definitive therapy of underlying obstruction. Percutaneous decompression of the obstruction allows time for improvement in renal function, treatment of urinary sepsis, and a more accurate assessment of the renal unit. Children with postoperative ureteral edema, leakage, or obstruction from extrinsic compression of calculi insertion or a percutaneous nephrostomy may be cured.

In rare instances, obstruction caused by a fungus ball may be treated with a combination of percutaneous nephrostomy and infusion of amphotericin (Fig. 26.3) (Matsumoto et al. 1990). In asymptomatic children with hydronephrosis, antegrade pyelography and pressure measurement (Whitaker test) may be performed prior to surgical or endourologic correction to document the level and nature of the obstruction. Finally, percutaneous nephrostomy

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**Fig. 26.1.** Neonate with bilateral UPJ obstructions. Five-French nephrostomy tubes in place

**Fig. 26.2.** Teenage girl with a dilated renal pelvis and equivocal Lasix renogram after a dismembered pyeloplasty. Whitaker test performed using a 2 needle technique demonstrating an enlarged renal pelvis due to an UPJ obstruction