

Chapter 58

Pediatric Genitourinary Interventions



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Evaluating the Patient

What labs should be ordered prior to any GU intervention?	CBC, PT/INR, and BUN/ Creatinine
	For patients undergoing PCN or stent placement, urinalysis, and urine culture may also be considered.

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What abnormality should be suspected in infants and children with recurrent UTIs? What is the test of choice for diagnosing this?	Vesicoureteral reflux (VUR). The test of choice is voiding cystourethrogram (VCUG).
In a patient with unilateral ureteral obstruction and severe unilateral hydronephrosis, would serum creatinine expected to be low, normal, or elevated?	Normal.
Which patients should be considered for general anesthesia?	Children undergoing PCN or stent placement (can be considered for renal biopsy in younger children).
Which patients may be considered for IV sedation?	Children undergoing renal biopsy or PCN/stent exchange.

High Yield History

You are consulted for placement of a PCN in a 3-month-old with hydronephrosis from ureteropelvic junction (UPJ) obstruction. In reviewing the patient's chart, you notice a history of ventricular septal defect and trachea-esophageal fistula. What other birth defects should you suspect?	Suspect VACTERL association
	V – Vertebral anomalies
	A – Anorectal malformations (e.g., imperforate anus)
	C – Cardiovascular anomalies

	T – Tracheoesophageal fistula
	E – Esophageal atresia
You perform a biopsy on renal mass in 4-year-old female. Pathology is consistent with Wilms tumor. What associated syndromes may be found when reviewing the patient's history?	WAGR (aniridia, GU abnormalities, mental retardation)
	Denys–Drash syndrome (gonadal dysgenesis, nephropathy)
	Beckwith–Wiedemann syndrome (hemihypertrophy, macroglossia)
What aspects on a patient's history increase their risk of UTI?	Young age (males <1-year-old, females <4 years-old), uncircumcised males, white race, incomplete voiding due to neurogenic bladder (e.g. spina bifida), and anatomic urinary obstruction (posterior urethral valves, extrinsic compression of the ureters, nephrolithiasis, etc.)
What aspects on a patient's history increase their risk of nephrolithiasis?	History of prior nephrolithiasis, family history of renal stones, recurrent UTI (especially <i>Proteus</i> or <i>Klebsiella</i> infections), structural abnormalities (e.g. UPJ obstruction or horseshoe kidney), metabolic disorder (e.g., hypercalciuria or hyperoxaluria), and ketogenic diet.

Indications/Contraindications

What are common contraindications to any GU intervention?	Uncorrectable coagulopathy or severe anemia, thrombocytopenia (platelets $<50,000 \times 10^6/L$), INR >1.5 , serious contrast allergy (e.g., anaphylaxis).
What are common indications for renal biopsy?	Histologic diagnosis for rising creatinine and worsening renal function, monitoring disease progression (e.g., lupus nephritis), and assessing for renal allograft rejection.
What are common indications for PCN placement?	Relief of urinary obstruction, drainage of complications of pyelonephritis, urinary diversion for urinary leaks, antegrade pyelogram, percutaneous calyceal access for nephrolithotomy.
What are common indications for dilation/stenting of ureteral strictures?	Congenital ureteral stenosis, fibrous bands, postoperative stricture (e.g., post-transplant), and anomalous ureteral insertions.
What are relative contraindications for dilation/stenting of ureteral strictures?	Strictures longer than 2 cm, active infection, significant segmental ureteral ischemia, recent surgery (e.g., ureteral implantation or renal transplant in the last 30 days).

Relevant Anatomy

The kidneys are located in the retroperitoneum at what vertebral level?	T12 to L2/L3. Due to the adjacent liver, the right kidney is typically slightly more inferior compared to the left.
What is the name of the fascia that defines the perirenal space?	Gerota's fascia.

In standard renal arterial anatomy, each kidney is perfused by one renal artery. What percentage of the population has multiple renal arteries?	30%. Accessory arteries may arise from the aorta or iliac arteries.
What is Brodel's line?	A relatively avascular plane located along the posterolateral kidney that lies between the anterior and posterior segmental branches of the renal artery.

Relevant Materials

What imaging modality is preferred for renal biopsy in pediatric patients?	Ultrasound. CT may be used for targeted lesions not well seen on ultrasound, difficult anatomy (e.g. severe scoliosis or ectopic kidneys), and morbidly obese patients.
What biopsy needle (size and type) should be used during renal biopsy?	16 G–18 G semiautomated core needle system. 18 G may be preferred in infants, children <10 kg, or patients with higher bleeding risk.
What imaging modality is most often used for guidance during PCN placement?	Ultrasound for percutaneous access into a calyx and fluoroscopy for placement of the catheter into the renal pelvis or bladder.
What size access needle should be used for PCN placement?	8–22 G needle.

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What guidewire (size and type) should be used to advance the PCN drainage catheter?	Begin with 0.018" wire advanced through the needle into the renal pelvis and dilate the percutaneous tract until the wire can be exchanged for a 0.035" relatively stiff guidewire (e.g., Amplatz or Rosen).
What PCN drainage catheter (size and type) should be used?	5–6 Fr locking (e.g., Cope loop) Pigtail catheter. Larger catheters (e.g., 8–10 F) can be used in older children >20 kg.
What imaging modality is most often used to guide dilation/stenting of ureteral strictures?	Fluoroscopy.
What guidewire (size and type) should be used to traverse a ureteral stricture?	For particularly tight strictures, an 0.018" guidewire may be necessary to cross the stenosis. Otherwise, a 0.035" hydrophilic guidewire is used.
What type of catheter may be used to traverse a ureteral stricture?	Angle-tipped hydrophilic catheter, usually 4 Fr.
What size angioplasty balloon should be used?	Balloon diameter should be 1–2 mm wider than the normal-appearing ureter. Measurements of the ureter should be obtained from the nephrostogram. Generally, 6–10 mm diameter balloons can be used for UPJ and UVJ strictures, whereas 4–6 mm diameter balloons are used for ureteral strictures.
Name two types of catheters that can be used for ureteral stenting.	Double-J catheter (i.e., nephroureteric stent; internal drainage) or percutaneous nephroureteral catheter (i.e., PCNU or internal-external drainage).

General Step by Step

What is ideal patient positioning for renal biopsy?	Prone or lateral decubitus with patient facing away from the operator. A wedge can be placed under the patient, above the iliac crest, to open the window between the iliac crest and the 12th rib.
What anatomic plane can be used to determine renal biopsy skin entry site?	Mid-scapular line.
Where is the ideal site to biopsy the kidney?	Inferior pole (reduces risk of pneumothorax) along the superficial cortex, where glomeruli are most dense.
What is ideal patient positioning for PCN placement?	Prone or oblique facing away from the operator.
What is the route of an ideal nephrostomy track?	Traversing the renal parenchyma and entering a posterior, middle, or inferior calyx,
What is the disadvantage of a direct puncture of the renal pelvis?	Limited surrounding renal parenchyma to provide tamponade against bleeding or urine leak as well as greater risk to hilar structures (e.g., renal vein/artery).
What is the “double stick” method?	A small-caliber needle (e.g., 22 G) is used to access the collecting system and inject a small amount of contrast to opacify the system. An ideal calyx is then targeted with a second needle under fluoroscopy.
Following the return of urine though the access needle, what is the next step?	Advance the guidewire through the needle, ideally into the ureter.

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What is the preferred final position of the nephrostomy catheter?	Advance until the Cope loop can be fully formed inside the renal pelvis.
What is the route of an ideal percutaneous nephrostomy track for dilation/stenting of ureteral strictures?	Interpolar or upper pole calyceal access reduces entry angle and offers more direct trajectory for accessing the UPJ and ureter.
After traversing the stricture with a hydrophilic wire and coiling it in the bladder, what is the next step?	Exchange for a stiff guidewire over which the angioplasty balloon can be passed.
If the stricture persists following multiple balloon dilations, what can be considered?	Dilation of the stricture using a cutting balloon.
How can the length of an internal ureteral stent be estimated?	Length (cm) = Patient age (yrs) + 10. Alternatively, the “bent wire method” may be used.

Complications

What are some minor complications of renal biopsy?	Asymptomatic perinephric hematoma (85%) and transient gross hematuria (6–8%).
What are some major complications of renal biopsy?	Hemorrhage requiring transfusion (1–3%), hematoma causing renal compression or Page kidney, vascular injury (arteriovenous fistula or pseudoaneurysm formation), or pneumothorax.

What are some minor complications of PCN placement?	Asymptomatic perinephric hematoma and transient gross hematuria.
What are some major complications of PCN placement?	Hemorrhage requiring transfusion, sepsis, and urine leak.
Following PCN placement, the patient develops rigors. What is the best course of management?	Demerol (0.8–1 mg/kg up to 50 mg IV).
	In addition, hemodynamic monitoring, IV fluid bolus, broad-spectrum antibiotics (e.g., Levofloxacin or Ampicillin/Sulbactam) should be considered.
What are some acute complications of ureteral stricture dilation/stenting?	Acute post-procedure obstruction (especially with balloon dilation without stent placement), transient hematuria, ureteral rupture and urine leak, and UTI/Urosepsis.
What are some delayed complications of ureteral stricture dilation/stenting?	Stent migration, recurrence, and need for additional intervention, UTI/Urosepsis.

Common Questions

How long following a renal biopsy should the patient be monitored?	Although observation time varies by institution, 98% of complications manifest within 24 hours.
How often should PCNs and stents be replaced?	Approximately every 2–3 months to prevent occlusion from calcification/debris and/or infection.

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Name two common reasons why a PCN or stent may stop draining.	Dislodgement (check suture site) or occlusion (flush with 5–10 mL of saline).
What is Nutcracker syndrome? How do affected patients often present?	Compression of the left renal vein between the SMA and the abdominal aorta. This results in venous hypertension which, if severe enough, can cause gross hematuria due to rupture of thin-walled varices into the renal collecting system. Patients may also present with a varicocele.

Further Reading

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