College of Health and Medical Technologies
Department of Radiology Technologies
Radiological procedures- 1

PERCUTANEOUS ANTEGRADE PYELOGRPHY AND NEPHROSTOMY

PERCUTANEOUS NEPHROLITHOTOMY

RENAL ARTERIOGRAPHY

2 nd stage

LECTUER 13

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PERCUTANEOUS ANTEGRADE PYELOGRPHY AND NEPHROSTOMY

This is the introduction of a drainage catheter into the collecting system of the kidney.

Indications

1. Renal tract obstruction
2. Pyonephrosis
3. Prior to percutaneous nephrolithotomy
4. Ureteric or bladder fistulae: external drainage (i.e. urinary diversion may allow closure)

Contraindications

Uncontrolled bleeding diathesis.

Contrast Medium

As for percutaneous renal puncture.

Equipment

1. Puncturing needle: coaxial needle/catheter set or sheathed 18G needle
2. Drainage catheter: at least 6-F pigtail with multiple side holes
3. Guidewires: conventional J-wire ± extra stiff wire
4. US and/or fluoroscopy—usually used in combination

Patient Preparation

1. Fasting for 4 h
2. Premedication as required
3. Prophylactic antibiotic

Technique

Patient position

Patient lies prone oblique with a foam pad or pillow under the abdomen to present the kidney optimally.

Identifying the collecting system prior to the definitive procedure

1. Freehand or with a biopsy needle attachment; US guidance is the most common method for localizing the kidney and guiding the initial needle puncture into the collecting system.
2. Excretion urography, if adequate residual function and a nondilated system using a parallax technique.
3. Occasionally retrograde injection through an ileal conduit or a ureteric catheter may be used to demonstrate the target collecting system.

Site/plane of puncture

A point on the posterior axillary line is chosen below the twelfth rib. Having identified the mid/lower pole calyces with US or contrast, the plane of puncture is determined. This will be via the soft tissues and renal parenchyma avoiding direct puncture of the renal pelvis, so that vessels around the renal pelvis will be avoided and the drainage catheter will gain some purchase on the renal parenchyma. There is a relatively avascular plane between the ventral and dorsal parts of the kidney, which affords the ideal access.

Techniques of puncture and catheterization

The skin and soft tissues are infiltrated with local anaesthetic using a spinal needle. Puncture may then be made using one of the following systems (depending on preference):

1. An 18G sheathed needle, or Kellett needle, using the Seldinger technique for catheterization. Contrast injection is used to confirm successful siting of the needle and for preliminary demonstration of the pelvicalyceal system. On occasion, air is used as a negative contrast medium to enable targeting of a posterior nondependent calyx. Upon successful puncture, a J-guidewire is

inserted and coiled within the collecting system; the sheath is then pushed over the wire, which may be exchanged for a stiffer wire. Dilatation is then performed to the size of the drainage catheter, which is then inserted. Care must be taken not to kink the guidewire within the soft tissues. Sufficient guidewire should be maintained within the collecting system, ideally with the wire in the upper ureter to maintain position, and if kinking does occur, the kinked portion of the wire can be withdrawn outside the skin.

2. Coaxial needle puncture systems using a 22/21G puncturing needle that takes a 0.018 guidewire. This affords a single puncture with a fine needle, with insertion of a three-part coaxial system to allow insertion of 0.035 guidewire and then proceeding as in list item (1).

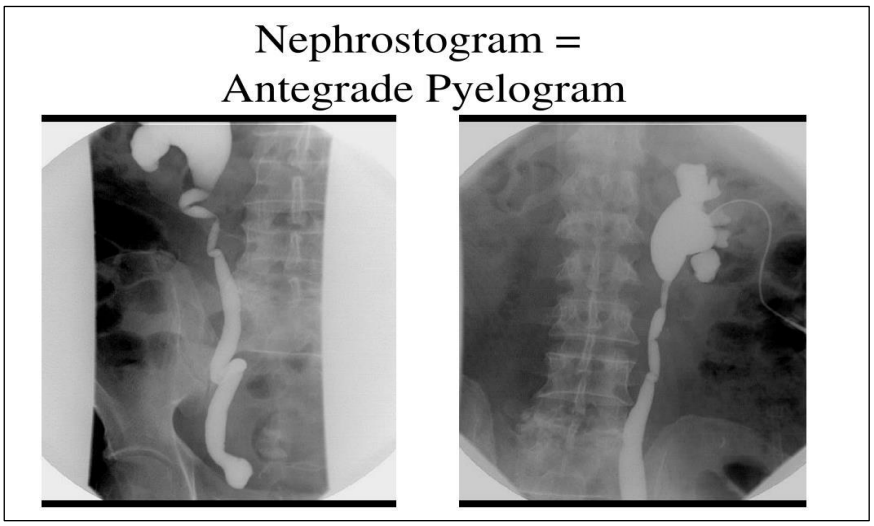
3. The trochar-cannula system, in which direct puncture of the collecting system is made with the drainage catheter already assembled over a trocar. On removal of the trocar, the drainage catheter is advanced further into the collecting system. Having successfully introduced the catheter, it is securely fixed to the skin and drainage commenced. Antegrade pyelography is rarely performed as an isolated procedure; usually it is undertaken following placement of, and via, a nephrostomy catheter, as noted previously. Oblique and AP images are taken with gentle introduction of water-soluble contrast medium. Semierect films may be necessary to encourage contrast medium down the ureters, to show the site and nature of obstruction. Postnephrostomy studies are best performed after a delay of 1–2 days, to allow the patient to recover and be able to cooperate, blood clot to resolve and infected systems to be drained.

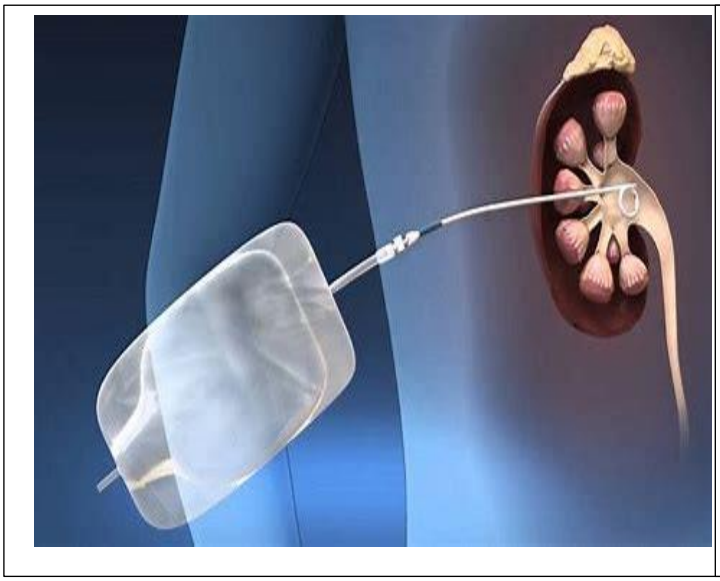
Aftercare

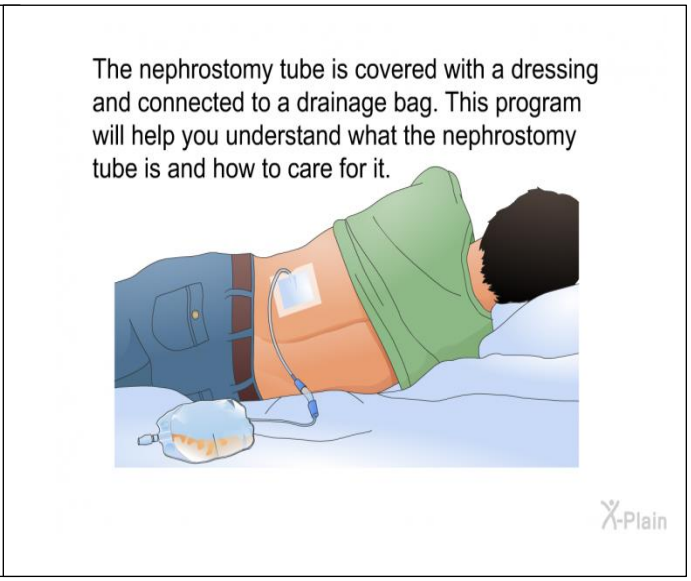
1. Bed rest for 4 h
2. Pulse, blood pressure and temperature half-hourly for 6 h
3. Analgesia
4. Urine samples sent for culture and sensitivity

Complications

1. Septicaemia
2. Haemorrhage
3. Perforation of the collecting system with urine leak
4. Unsuccessful drainage
5. Injury to adjacent organs such as lung, pleura, spleen or colon
6. Later catheter dislodgement







PERCUTANEOUS NEPHROLITHOTOMY

This is the removal of renal calculi through a nephrostomy track. It is often reserved for large complicated calculi, which are unsuitable for extracorporeal shock-wave lithotripsy.

Indications

1. Removal of renal calculi
2. Disintegration of large renal calculi

Contraindications

Uncontrolled bleeding diathesis.

Contrast Medium

As for percutaneous renal puncture.

Equipment

1. Puncturing needle (18G): Kellett (15–20 cm length) or equivalent
2. Guidewires, including hydrophilic and superstiff
3. Track dilating equipment; Teflon dilators (from 7-F to 30-F), metal coaxial dilators or a special angioplasty-type balloon catheter
4. US machine
5. Fluoroscopy facilities with rotating C arm, if possible

Patient Preparation

1. Full discussion between radiologist/urologist concerning indications and so on
2. Imaging (IVU, CT KUB, CTU) to demonstrate position of calculus and relationship to calyces
3. General anaesthetic
4. Coagulation screen
5. Two units of blood cross matched
6. Antibiotic cover
7. Premedication

8. Bladder catheterization, as large volumes of irrigation fluid will pass down the ureter during a prolonged procedure

Technique

Preprocedure planning may include a CT KUB and CTU to localize stones and to choose most appropriate access.

Patient position

As for a percutaneous nephrostomy, usually prone.

Methods of opacification of the collecting system

1. Retrograde ureteric catheterization for demonstration and distension of the collecting system may be achieved. In addition, a retrograde occlusion balloon catheter in the ureter will prevent large fragments of stone passing down the ureter
2. Intravenous excretion urography
3. Antegrade pyelography; this also enables distension of the collecting system.

Puncture of the collecting system

A lower pole posterior calyx is ideally chosen if the calculus is situated in the renal pelvis. Otherwise the calyx in which the calculus is situated is usually punctured. Special care must be taken if puncturing above the twelfth rib, because of the risk of perforating the diaphragm and pleura. Puncture is in an oblique plane from the posterior axillary line through the renal parenchyma. Puncture of the selected calyx is made using a combination of US and a rotating C-arm fluoroscopic facility. On successful puncture, a guidewire is inserted through the cannula, and as much wire as possible is guided into the collecting system. The cannula is then exchanged for an angled catheter, and the wire and catheter are manipulated into the distal ureter. At this stage full dilatation may be performed (single stage) or a nephrostomy tube left in situ with dilatation later (two-stage procedure).

Dilatation

This is carried out under general anaesthesia. It is performed using Teflon dilators from 7-F to 30-F, which are introduced over the guidewire. Alternatively, metal coaxial dilators or a special angioplasty balloon (10 cm long) are used. A sheath is inserted over the largest dilator or balloon, through which the nephroscope is passed followed by removal of the calculus or disintegration.

Removal/disintegration

Removal of calculi of less than 1 cm is possible using a nephroscope and forceps. Larger calculi must be disintegrated using an ultrasonic or electrohydraulic disintegrator.

Aftercare

1. A large bore soft nonlocking straight nephrostomy tube (sutured) is left in for 24 h following the procedure.
2. Patient care is usually determined by the anaesthetist/urologist.
3. Plain radiograph of the renal area to ensure that all calculi/ fragments have been removed.

Complications

Immediate

1. Failure of access, dilatation or removal
2. Perforation of the renal pelvis on dilatation
3. Inadvertent access to renal vein and IVC
4. Haemorrhage. Less than 3% of procedures should require transfusion. Rarely, balloon tamponade of the tract or embolization may be required.
5. Damage to surrounding structures (i.e. diaphragm, colon, spleen, liver and lung)
6. Problems related to the irrigating fluid

Delayed

1. Pseudoaneurysm of an intrarenal artery
2. Arteriovenous fistula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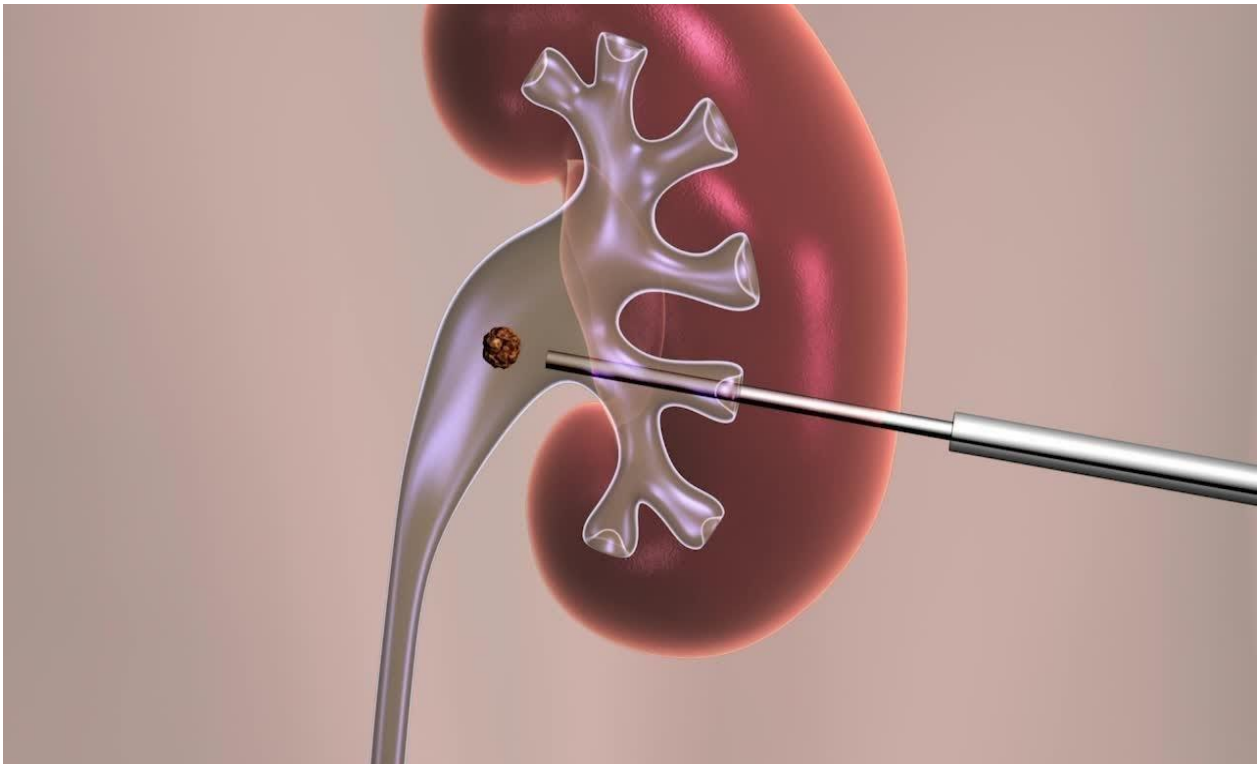


RENAL ARTERIOGRAPHY

Indications

1. Renal artery stenosis prior to angioplasty or stent placement. Diagnostic arteriography has been replaced generally by MR or CT angiography (MRA or CTA).
2. Assessment of living related renal transplant donors—replaced generally by MRA or CTA
3. Embolization of vascular renal tumour prior to surgery
4. Haematuria particularly following trauma, including biopsy. This may precede embolization.
5. Prior to prophylactic embolization of an angiomyolipoma (AML) or therapeutic embolization of a bleeding AML.

Contrast medium

Flush aortic

LOCM 300/320 mg I mL−1, 45 mL at 15 mL s−1.

Selective renal artery injection

LOCM 300 mg I mL−1, 10 mL at 5 mL s−1, or by hand injection.

Equipment

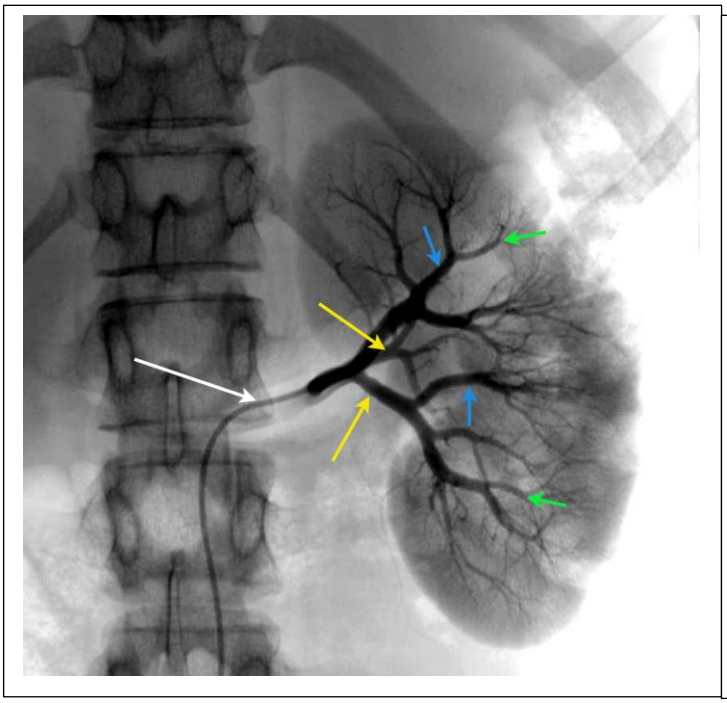
1. Digital fluoroscopy unit
2. Pump injector
3. Catheters:

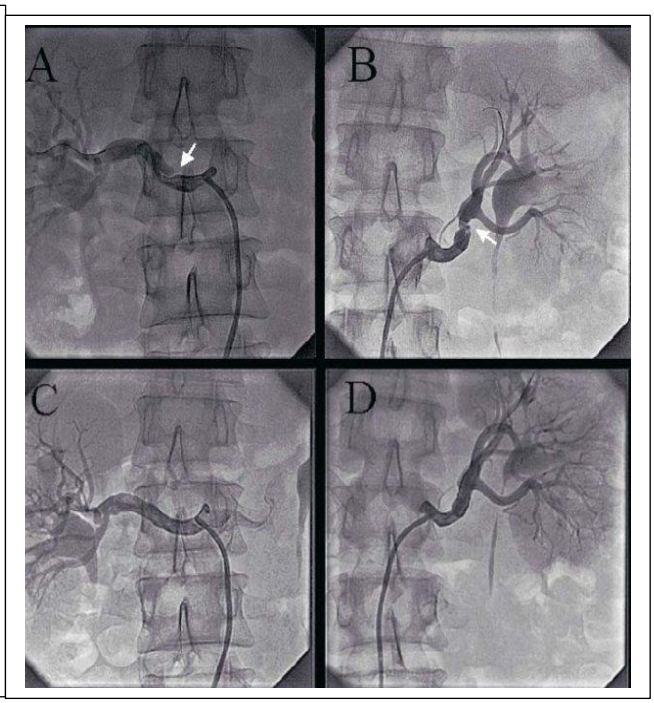
• Flush aortic injection—pigtail 4-F
• Selective injection—Sidewinder or Cobra catheter

Technique

Femoral artery puncture

For flush aortography, a pigtail catheter is placed proximal to the renal vessels (i.e. approx. T12) and AP, and oblique runs are performed (the oblique run demonstrating the renal origins). Selective catheterization as required is used with appropriate catheters for optimal demonstration of intrarenal vessels, and prior to interventional procedures.





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