Republic of Iraq
Ministry of Higher Education
Al-Mustaqbal University
Radiology Techniques Department
Second Stage \ Special Radiological Procedures-1

Lecture No. (12)

Percutaneous Antegrade Pyelography and Nephrostomy

Percutaneous Nephrolithotomy

&

Renal Arteriography

By

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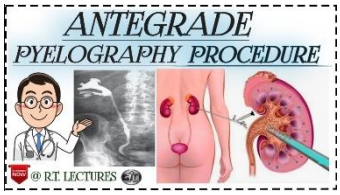
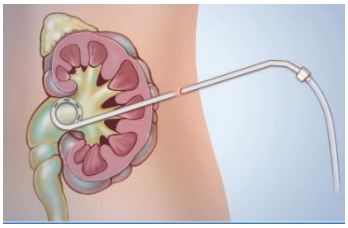
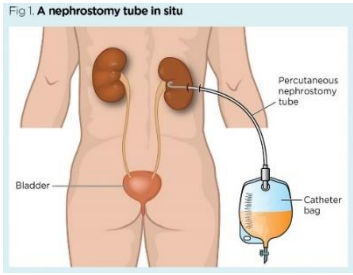
Percutaneous Antegrade Pyelography and Nephrostomy

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

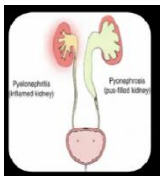
Indications







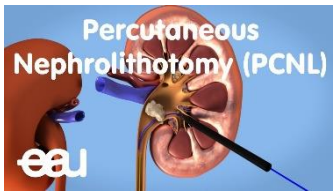
1. Renal tract obstruction
2. Pyonephrosis
3. Prior to percutaneous nephrolithotomy
4. Ureteric or bladder fistulae: external drainage (i.e. urinary diversion may allow closure)

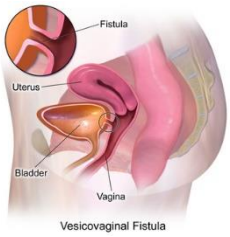


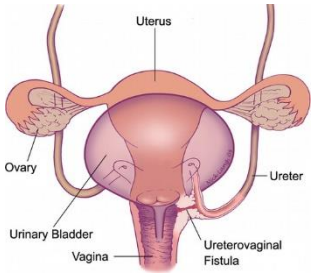
Contraindications

Uncontrolled bleeding diathesis. (bleeding tendency) → **Percutaneous**

Contrast Medium







As for percutaneous renal puncture.

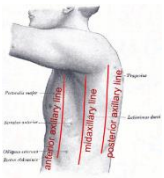
Equipment

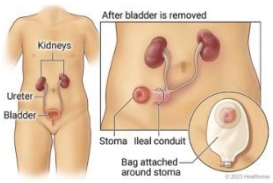
1. Puncturing needle: **coaxial needle**/catheter set or **sheathed** 18G needle
2. Drainage catheter: at least 6-F pigtail with multiple side holes
3. Guidewires: **conventional J-wire** ± extra stiff wire
4. US and/or fluoroscopy—usually used in combination

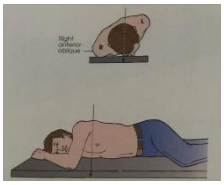
Patient Preparation

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**.**

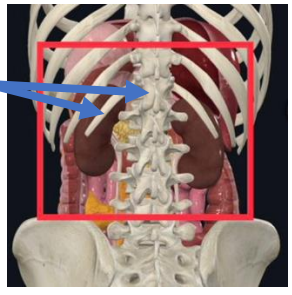
3. **Occasionally** retrograde injection through an ileal conduit or a ureteric catheter may be used to demonstrate the target collecting system (pelvicalyceal system).

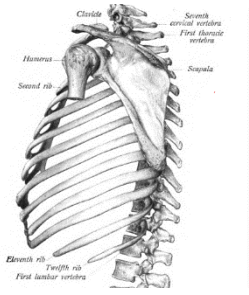
Site/plane of puncture

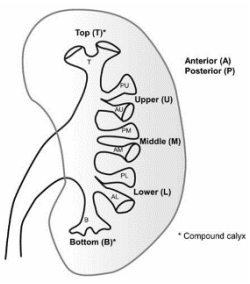
A point on the posterior axillary line is chosen below the twelfth rib (12 rib). Having **identified** the mid/lower pole calyces with US or contrast, the plane of **puncture** is **determined**. This will be via the soft tissues and renal parenchyma avoiding **direct puncture** of the renal pelvis, **so** that vessels around the renal pelvis will be avoided and the drainage catheter will gain some purchase on the renal parenchyma.

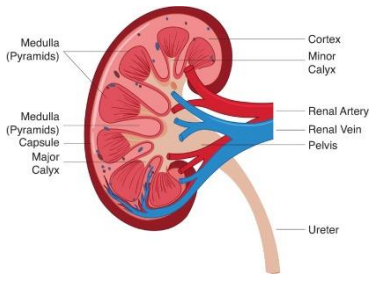
T-12

R-12









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):

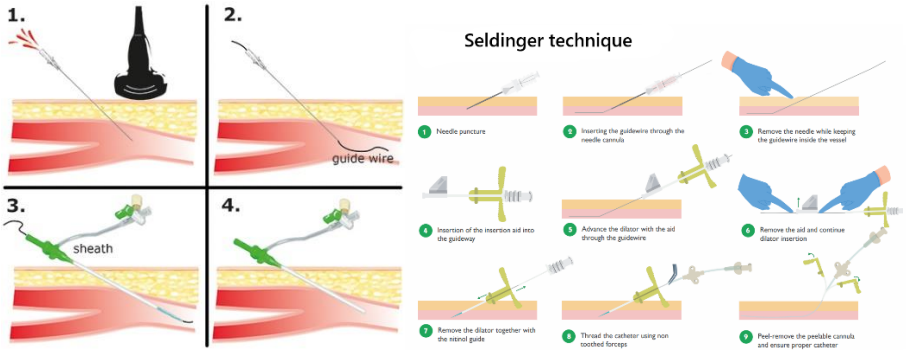
1. **An 18G sheathed needle**, or **Kellett needle**, using the Seldinger technique for catheterization.

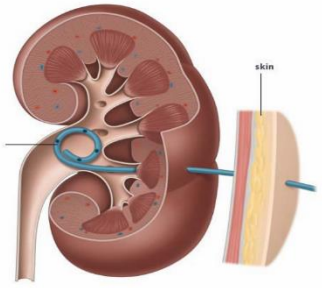
***Contrast injection** is used to confirm successful siting of the needle and for preliminary demonstration of the pelvicalyceal system.

*****On occasion, air is used as a negative contrast medium to **enable targeting** of a posterior nondependent calyx.

Upon successful needle 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.

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**.

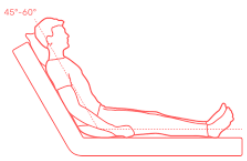
Having successfully introduced the catheter, it is securely fixed to the skin and drainage commenced.

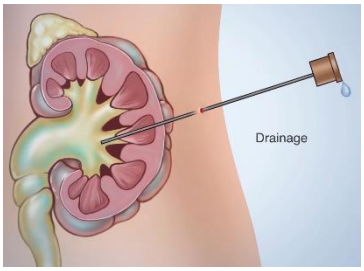
*Antegrade pyelography is rarely performed as an isolated procedure; usually, it is undertaken following placement of, and via, a nephrostomy catheter, as noted previously.

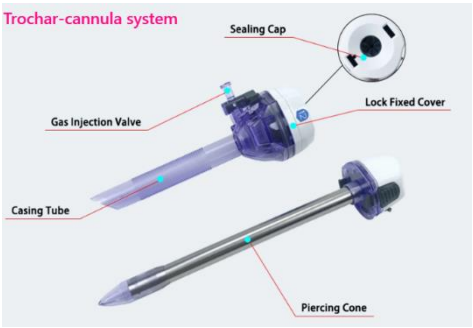
* Oblique and AP images are taken with gentle introduction of water-soluble contrast medium.

* 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

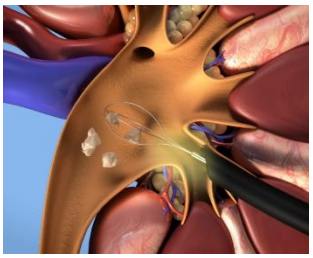
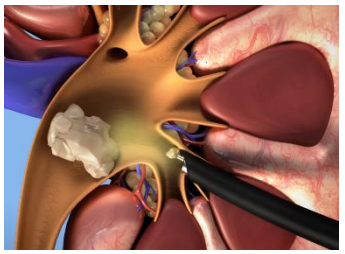
4. Urine samples sent for culture and sensitivity

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

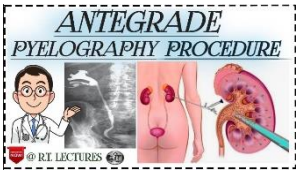
6. Antibiotic cover

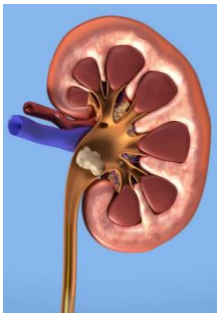
7. Premedication

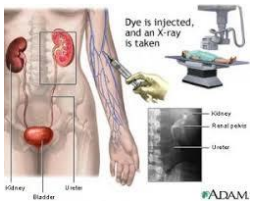
8. Bladder catheterization, as large volumes of irrigation fluid will pass down the ureter during a prolonged procedure

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

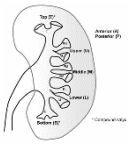
1. Retrograde ureteric catheterization **for**

   -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.

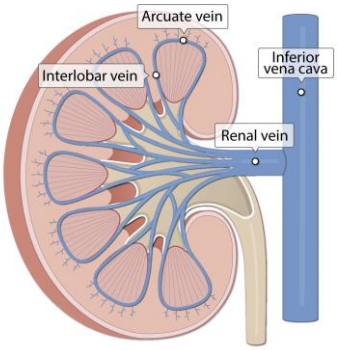
Aftercare

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

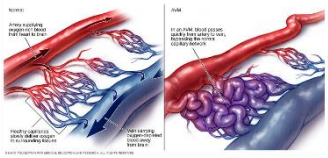
1. Failure of access, dilatation or removal

2. Perforation of the renal pelvis **on** dilatation

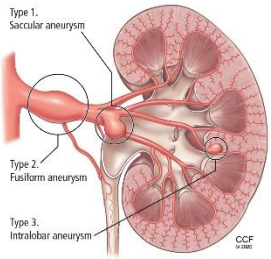
3. Inadvertent access to renal vein and IVC

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

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).

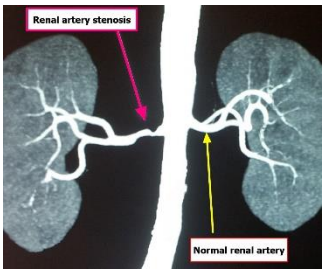
2. Assessment of living related renal transplant donors—**replaced** by MRA or CTA

3. Embolization of vascular renal tumour prior to surgery

due to invasive procedure

4. Haematuria particularly **following trauma**, including **biopsy**. This may precede embolization.

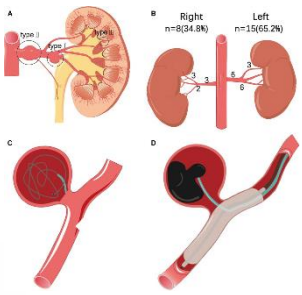
5. Prior to prophylactic embolization of an angiomyolipoma (AML) or therapeutic embolization of a bleeding AML.



Contrast medium

Flush aortic

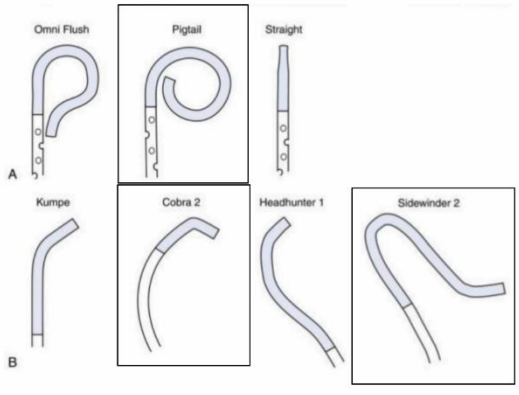
LOCM 300/320 mg I mL−1, 45 mL at 15 mL s−1.



Selective renal artery injection

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

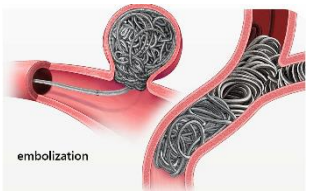
Equipment



1. Digital fluoroscopy unit

2. Pump injector

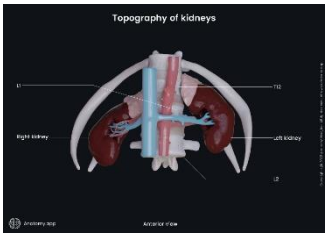
3. Catheters:



• 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**.

……..

Q1. What is the purpose of percutaneous antegrade pyelography and nephrostomy?

A. Removal of kidney stones B. Treatment of urinary tract infections

C. Induction of renal tract obstruction

D. Introduction of a drainage catheter into the collecting system of the kidney E. All of the above

Q2. During the percutaneous antegrade pyelography exam, the suitable position to encourage contrast medium down the ureters is .....

A. Patient lies prone oblique B. Lateral position

C. Oblique and AP positions D. Erect position E. Semierect position

Q3. The percutaneous antegrade pyelography and nephrostomy may be require to perform prior to ....

A. Renal surgery B. Kidney transplant C. Renal arteriography

D. IVU E. Percutaneous nephrolithotomy

Q4. The patient preparation of percutaneous antegrade of pyelogrphy and nephrostomy should

A. Be fasting for 4 hours B. Drink fluids only C. Gastric be empty

D. Take antibiotic E. None of the above

Q5. What is the purpose of fasting for 4 hours before percutaneous antegrade pyelography and nephrostomy?

A. To reduce the risk of aspiration and vomiting

B. To reduce the interference and dilution of the contrast medium

C. To reduce the bowel gas and improve the image quality

D. All of the above E. None of the above

Q6. What is/are recommendation(s) following percutaneous antegrade pyelography and nephrostomy?

A. Bed rest for 4 hours B. Pulse, blood pressure and temperature half-hourly for 6 hours

C. Urine samples sent for culture and sensitivity D. Analgesia E. All of the above

Q7. The puncture site for percutaneous antegrade pyelography and nephrostomy is

A. Along the midline of the back B. At the level of the umbilicus

C. On the anterior axillary line D. On the posterior axillary line

E. Below the twelfth rib on the posterior axillary line

Q8. What is the contraindications for percutaneous antegrade pyelography?

A. Uncontrolled bleeding diathesis. B. Renal tract obstruction

C. Pyonephrosis D. Prior to percutaneous nephrolithotomy E. Ureteric or bladder fistulae

Q9. One of the followings is contraindication ofpercutaneous nephrostomy?

A. Renal tract obstruction B. Pyonephrosis C. Uncontrolled bleeding diathesis

D. prior to percutaneous nephrolithotomy E. Ureteric or bladder fistula

Q10. The percutaneous antegrade pyelography and nephrostomy is typically performed.....

A. To detect bladder cancer B. To assess renal blood flow

C. In the presence of pyonephrosis D. To evaluate renal cysts E. To evaluate ureteral trauma

Q11. Ureteric or bladder fistulae is one indication of the .....

A. Nephrostomy study B. Barium enema C. IVU study D. Barium meal

E. Barium swallow

Q12……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.

A. HSG study B. Post-nephrostomy study C. IVU study

D. Retrograde pyeloyreterography study E. MRCP stud

……

Q1. The percutaneous nephrolithotomy procedure is

A. Examination of the urinary tract under CT scan

B. Fluoroscopic screening to determine level of obstruction

C. Treatment of perinephric collections

D. Removal of bladder stones by cystoscopy

E. Removal of renal stones through a nephrostomy track

Q2. Equipment of percutaneous nephrolithotomy include the followings except.

A. US machine B. Puncturing needle (18G) C. Track dilating equipment

D. Guidewires E. Pump injector

Q3. A delayed complication that can occur after percutaneous nephrolithotomy is.....

A. Arteriovenous fistula B. Acute kidney injury C. Ureteral stricture

D. Damage to colon E. Damage to diaphragm

Q4. When is percutaneous nephrolithotomy typically performed?

A. In cases of bladder cancer B. To assess renal blood flow

C. For the disintegration of large renal calculi D. Renal stone E. To evaluate ureteral trauma

Q1. Diagnostic renal arteriography has been replaced generally by.

A. Conventional ultrasound D. MRI urography B. Contrast enhanced ultrasound

C. Volume of ovaries D. CT urography E. MRA

Q2. Technique of renal arteriography femoral artery puncture for flush aortography, a pigtail catheter is placed proximal to the renal vessels approximately at level.

A. T1 B. T4 C. T7 D. T9 E. T12

Q3. What is the most common cause of haematuria that may require renal arteriography and embolization?

A. Trauma B. Infection C. Stone D. Cancer E. Polycystic kidney disease

Q4. Which of the following equipments are commonly used in renal arteriography?

A. Digital fluoroscopy unit B. X-ray film cassettes

C. Magnetic resonance imaging machine D. Pump injector E. A and D

Q5-Which of the following are indications for renal arteriography?

A. Renal artery stenosis prior to angioplasty or stent placement.

B. Assessment of living related renal transplant donors-replaced by MRA or CTA.

C. Embolization of vascular renal tumor prior to surgery.

D. Hematuria particularly following trauma, including biopsy.

E. All of the above