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

COMPUTED TOMOGRAPHY URINARY TRACT

2 nd stage

LECTUER 8

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Aquilion
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COMPUTED TOMOGRAPHY URINARY TRACT

Indications

1. Renal colic/renal stone disease
2. Renal tumour
3. Renal/perirenal collection
4. Loin mass
5. Staging and follow-up of renal, collecting system or prostatic cancer (local staging of prostatic cancer is performed using thin-section MRI)
6. Investigation of renal tract obstruction
7. CT angiography may be used to assess renal vessels for suspected renal artery stenosis or arteriovenous fistula or malformation.

Techniques

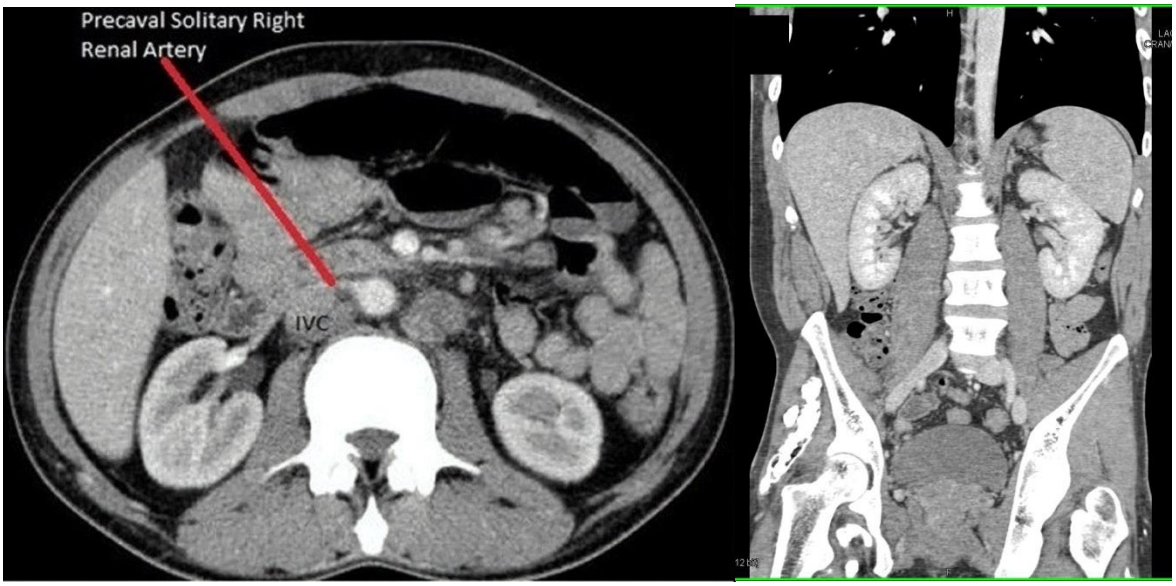
Standard diagnostic computed tomography

This technique is used to stage and follow-up known renal-tract malignancy or to investigate nonspecific signs attributed to the renal tract. Examination of the thorax in addition to the abdomen and pelvis is usually performed, where pulmonary metastatic disease or mediastinal nodal spread is a possibility:

1. Venous access is obtained.
2. Patient lies supine.
3. Scanogram is taken of chest, abdomen and pelvis as appropriate.
4. 100 mL i.v. LOCM given.
5. Scans obtained approximately 70 s (portal venous phase) after i.v. contrast (arterial phase scans of the liver may be appropriate in those patients with suspected metastatic renal cancer who may have hypervascular liver metastases).

Renal lesion characterization computed tomography this is used to assess renal cysts or masses identified on another imaging modality such as ultrasound. Pre- and post-i.v. contrast scans are obtained through the kidneys in order to assess precontrast attenuation and subsequent enhancement patterns. Many practitioners advise the postcontrast scan be performed at 100 s (nephrographic

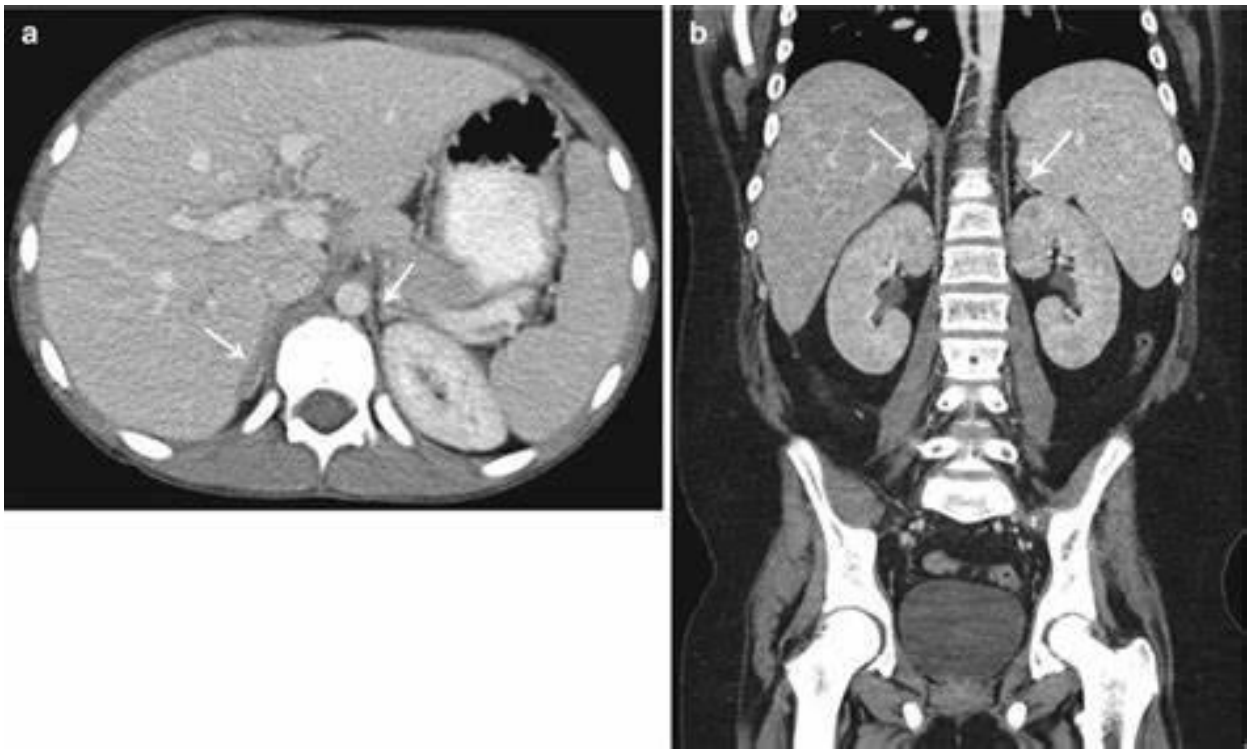
phase) to prevent small intraparenchymal lesions being obscured by corticomedullary differentiation.



Adrenal lesion characterization computed tomography

Indication: Adrenal mass is suspected or needs characterization.

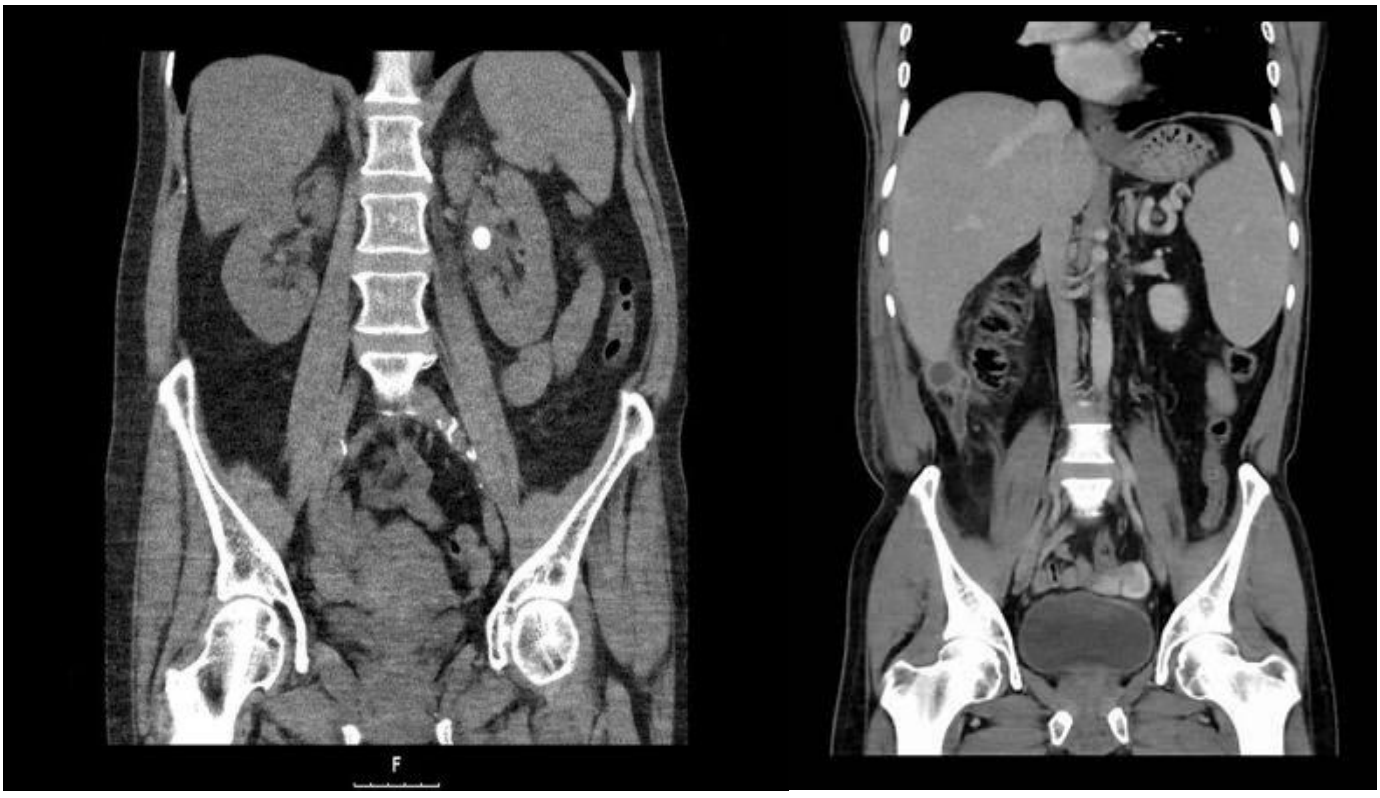
Technique: Unenhanced CT of the abdomen to enable measurement of attenuation (HU) of any adrenal mass. A value less than 10 HU is highly specific for a benign (lipid-rich) adenoma, and is often the only test required. This may, however, be supplemented when necessary by washout CT, remeasurement of the adrenal density in Hounsfield units at 15 min following i.v. contrast. Benign adenomas (whether or not lipid-rich) typically show rapid washout of contrast; an absolute percentage washout (APW) greater than 60% or relative percentage washout (RPW) greater than 40%, on delayed images, is highly specific for a benign lesion.



Computed tomography kidneys, ureters, bladder

Plain CT (commonly referred to as CT KUB—kidneys, ureters, bladder) is useful to assess possible stone disease. It is now used in most centres as the primary investigation of renal colic (replacing plain KUB radiograph):

1. No i.v. or oral contrast is given.
2. Patient supine. (Some authorities advise prone scanning to differentiate if stones are impacted at the vesicoureteric junction or have passed into the bladder.)
3. A low-radiation-dose technique is used to scan from the top of the kidneys to include the bladder base with a slice thickness of 5 mm or less, as determined by CT scanner. (Due to the low-dose nature of the scan and the absence of i.v. and oral contrast, the scan has a very limited role in identifying pathology other than renal tract calculus disease and should not be used indiscriminately for investigation of non-specific abdominal pain.)

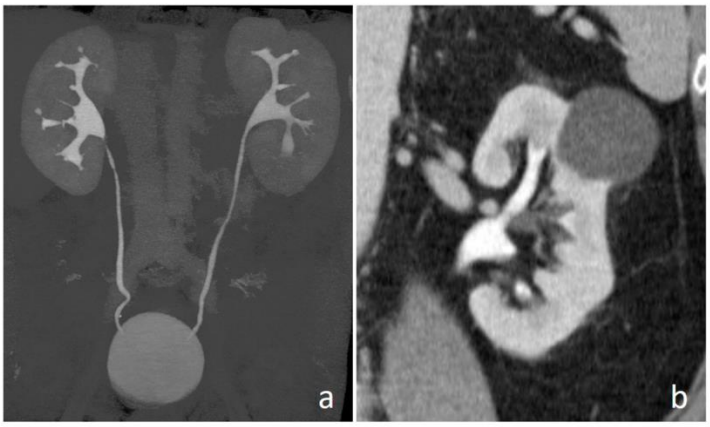


Computed tomography urogram (CTU)

This technique uses a combination of unenhanced, nephrographic and delayed scans following i.v. contrast to sequentially allow examination of renal parenchyma and collecting systems.

Suggested protocol includes the following:

1. An oral water load of 500–1000 mL 45–60 min before injection is recommended to ensure a diuresis and collecting system dilatation. No positive oral contrast is given.
2. Patient supine
3. Initial low-dose unenhanced scans of urinary tract (CT KUB) to determine if renal tract calculus disease is present
4. LOCM 300 mg I mL−1 100 mL is given as bolus intravenously.
5. Thin-section (usually 1 mm) scans are obtained from the diaphragm to lower poles of kidneys during the nephrographic/ parenchymal enhancement phase (100 s following start of bolus injection). Alternatively, the scan may instead be acquired during the portal venous phase (70 s), but normal corticomedullary differentiation may make small tumours difficult to appreciate.
6. Delayed thin-section (1 mm) scans are acquired from upper pole of kidneys to bladder base 20 min after contrast injection, to examine collecting systems and ureters.
7. Source images are reviewed along with multiplanar reconstructions. Postprocessing with maximum-intensity projections and surfaceshaded displays may be helpful, especially for demonstration.



Variations

The nephrographic phase may be omitted if the scan is specifically for urothelial tumour or collecting system assessment. Some protocols use diuretics or abdominal compression bands to achieve collecting system distension. Radiation dose is a significant consideration for a triple-phase CTU (compared with an IVU), but newer iterative reconstruction techniques increasingly available are reducing this. Some authorities advocate the use of a split bolus technique, i.e. 50 mL of i.v. contrast 10–15 min before scanning, with a further 50 mL at the time of the scan, to achieve demonstration of the nephrographic and pyelographic phases in the same acquisition with consequent radiation dose saving.

Computed tomography angiography

Angiography principles.

Indications

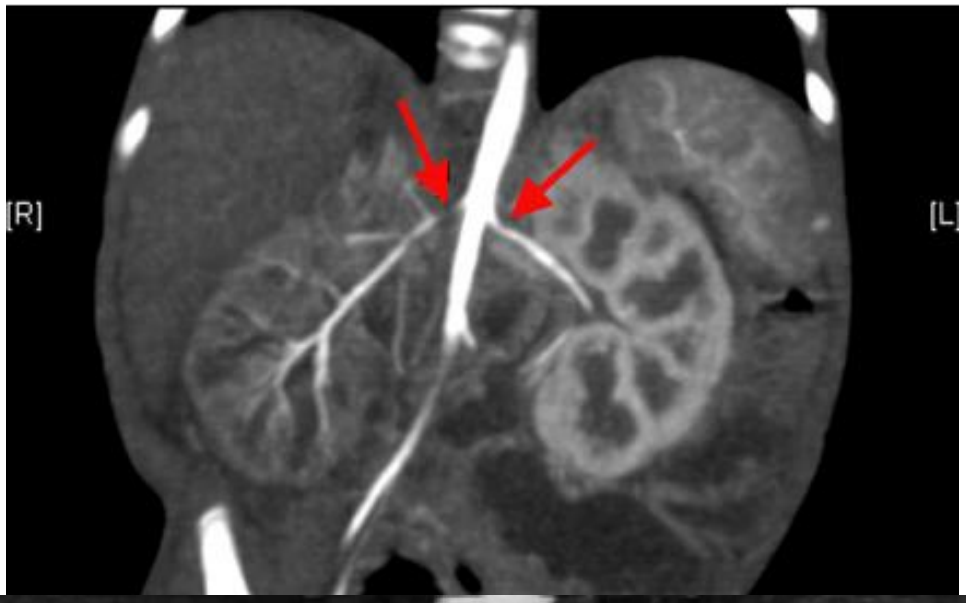
1. Renal artery stenosis
2. Renal artery aneurysm, arteriovenous malformation, dissection or thrombosis
3. Delineation of vascular anatomy prior to laparoscopic surgery, e.g. nephrectomy, pyeloplasty

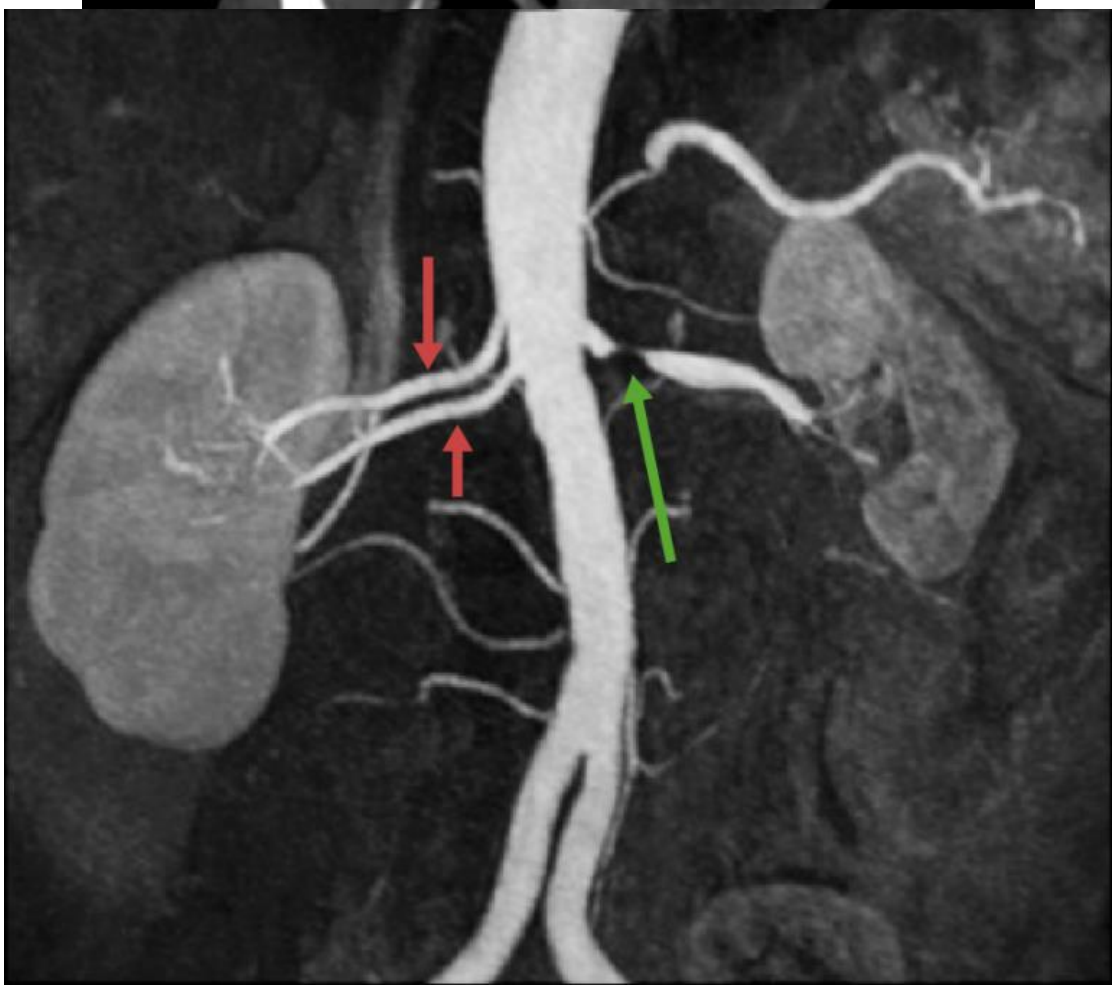
Technique

1. No oral iodinated contrast used.
2. Scan from the upper pole of the kidneys to the aortic bifurcation.

Modern scanners are fast enough to produce high quality studies of the whole abdomen.

3. Narrow collimation (1 mm).
4. 100–150 mL i.v. contrast medium (LOCM 300) injected at 3–4 Ml s−1.
5. Use of bolus tracking/triggering devices or timing test injections is recommended to ensure appropriate timing. Otherwise scans are initiated after a preset empiric delay of 20–25 s from start of contrast material injection.
6. Source axial scans are supplemented by multiplanar reconstructions and maximum intensity projection, and volume-rendered surface shaded display postprocessing.





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