Diagnostic Imaging Pathways - Renal Failure (Acute or Acute on Chronic)

Population Covered By The Guidance

This pathway provides guidance on the imaging of adult patients with new onset or acutely worsening renal failure.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

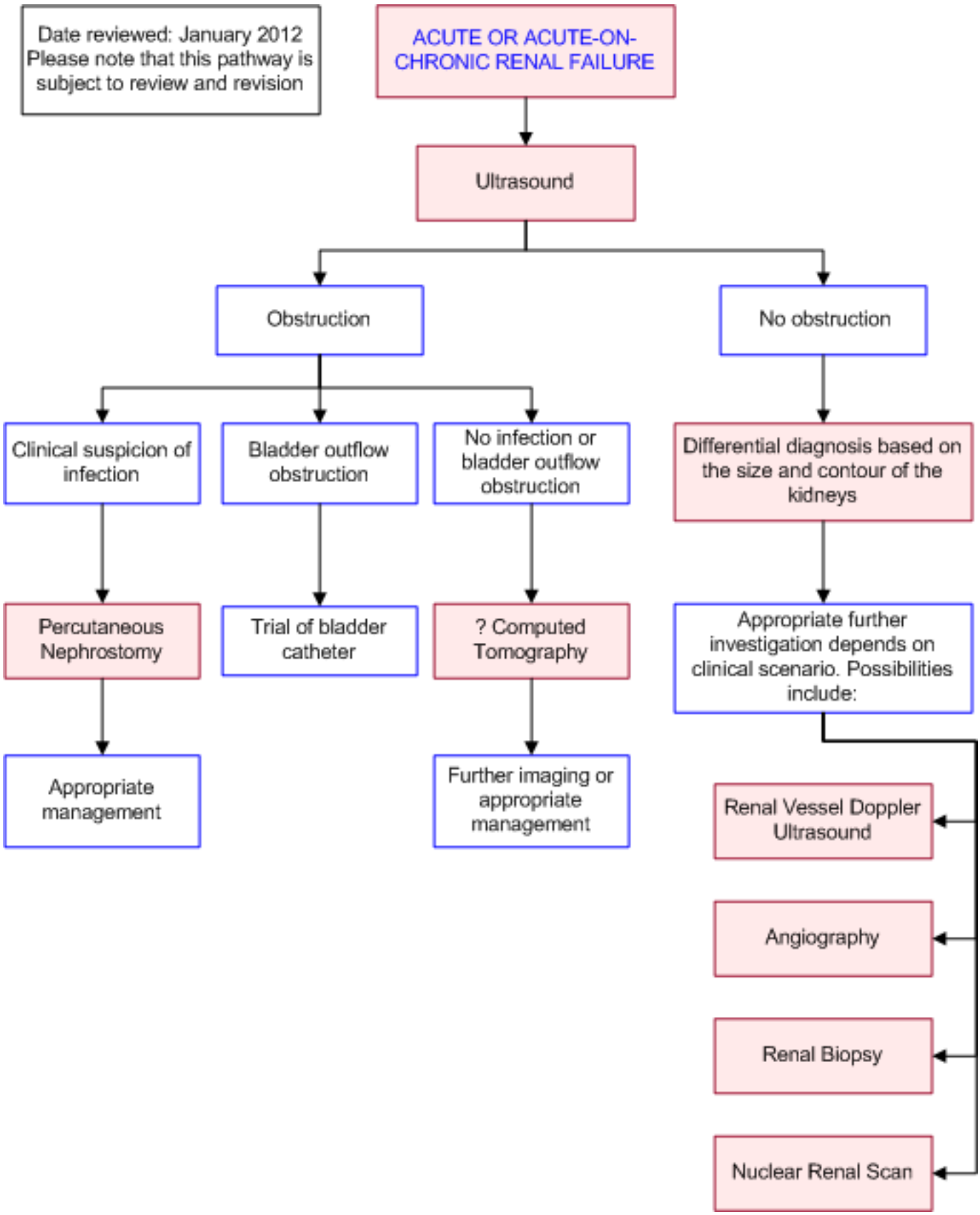
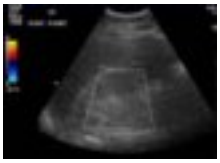


Image Gallery

Note: These images open in a new page

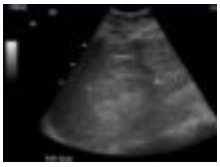
1a

1b

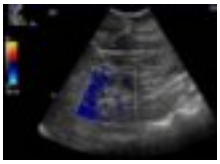


1c

1d



1e



Acute on Chronic Renal Failure

Image 1a, 1b, 1c (Right Kidney - Ultrasound), 1d and 1e (Left Kidney - Ultrasound): Both kidneys are small and echogenic. The right kidney measures 7.8cm and the left kidney measures 8.9cm. There is no evidence of hydronephrosis and no renal calculi are seen. No vascular flow could be demonstrated within the parenchyma one either side. No collection is seen around either kidney. The bladder which is not illustrated here is well distended without focal abnormality. Vesicoureteric jets could not be visualised. These images are consistent with a chronic process such as a vasculitis.

Teaching Points

- Ultrasound is the modality of choice and is used to exclude obstructive uropathy and to assess renal size and contour
- In the absence of obstruction and evidence of pre-renal failure, the size and contour of the kidneys can be useful to assess the underlying cause of the renal failure
- Further imaging in non-obstructive uropathy depends on the provisional diagnosis. For example Doppler US may be used to assess for renal artery stenosis

Angiography

- Catheter or CT angiography involves use of iodinated contrast medium, which is usually contraindicated in acute renal failure. MR angiography is a useful alternative in these circumstances

Renal Biopsy

- When the cause of declining renal function is not found and the clinical features are atypical of acute tubular necrosis, renal biopsy may be used to exclude potentially treatable conditions such as Wegener's granulomatosis, systemic lupus erythematosus, Goodpasture's syndrome or rapidly

progressive glomerulonephritis

Differential Diagnosis Based On The Size And Contour Of The Kidneys

- Smooth, small kidneys
  - chronic glomerulonephritis
  - renovascular cause
  - post-obstructive atrophy
- Scarred, small kidneys
  - chronic pyelonephritis
  - tuberculosis
  - papillary necrosis
- Normal sized or large kidneys
  - polycystic kidneys
  - renal vein thrombosis
  - infiltration
  - acute tubular necrosis

Renal Vessel Doppler Ultrasound

- Doppler gives information regarding blood flow velocities and waveform
- 63-100% sensitivity and 73-100% specificity for renal artery stenosis 10
- Doppler ultrasound can be used to distinguish renal obstruction from non-obstructive dilatation. A renal resistive index (RI) of 0.7 or less in the presence of dilatation of collecting system is supportive evidence of absence of functionally significant obstruction 4,5,6
- A renal resistive index value of at least 0.8 reliably identifies patients with renal-artery stenosis in whom angioplasty or surgery will not improve renal function, blood pressure, or kidney survival 11
- Patients with abnormal US or high clinical suspicion of renal artery stenosis need to be further evaluated with MRA or CTA 12,13
- Advantages: non-invasive, relatively inexpensive, does not involve the use contrast material and no exposure to ionising radiation.
- Limitations: difficult in obese patients and where breath holding and cooperation are poor 14

Percutaneous Nephrostomy

- Percutaneous nephrostomy is performed as a temporary means of urinary diversion
- A nephrostogram allows assessment of the level of obstruction and may also determine the cause
- If indicated, antegrade ureteric stenting can be performed through the nephrostomy tract

Radionuclide Renal Scan

- Renal perfusion, filtration and excretion can be evaluated which are helpful in determining the potential for salvage 7,8,9
- There are no comprehensive series describing DTPA or MAG3 renography in patients with acute renal failure and no evidence that serial renography contributes more to patient management than does the measurement of urine volume and creatinine content 9

Ultrasound

- Modality of choice for renal imaging 1,2
- Routine use is not indicated 2,3
- Provides morphological and functional information useful for the diagnosis and management of specific pathological conditions leading to acute renal failure 1,2
- Helps differentiate potentially reversible acute renal failure from chronic end-stage renal disease 1,2
- Allows detection of obstruction, assessment of renal size and outline 4
- Renal size is usually normal in prerenal acute renal failure and it may increase in acute renal diseases such as acute tubular necrosis, interstitial nephritis and acute glomerular nephritis. Reduced size suggests a complicated underlying chronic nephropathy and worse prognosis 1
- Limitations 1,2
    - Poor specificity
    - False negatives may occur in early renal obstruction and in dehydrated patients

References

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. Download the document

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Ultrasound (Doppler)	