

Radiological diagnosis of kidney stones

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GUIDELINES

No recommendations possible based on Level I or II evidence

SUGGESTIONS FOR CLINICAL CARE

(Suggestions are based on Level III and IV evidence)

- **Imaging confirms the presence of renal calculus disease and for the urologist, assists in determining outcome and management. Studies confirm that when available, non-contrast helical computed tomography (CT) scanning (spiral) has superior sensitivity and specificity in the detection of stones.**

BACKGROUND

Urinary and extraurinary abnormalities, including ureterolithiasis, cause acute flank pain, which is a common and complex clinical problem. Radiological studies have an important place in the differential diagnosis of flank pain and renal calcifications. There needs to be a non-nephrotoxic and highly sensitive means of eliciting stones as stone pain is extreme and patients need rapid diagnosis. With the advent of non-contrast CT scanning, the toxicity is now reduced and the sensitivity is higher than with any other modality.

This guideline summarizes the evidence on the advantages, disadvantages and the diagnostic value of radiological procedures in patients with flank pain and renal calcifications.

SEARCH STRATEGY

Databases searched: Medline (1966–July Week 4 2004). MeSH terms and text words for kidney stones were combined with MeSH terms and text words for radiological diagnosis. The results were combined with the Cochrane search strategy for radiological diagnostic studies.

Date of searches: 20 August 2004.

WHAT IS THE EVIDENCE?

No randomized controlled trials are available that address this issue.

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Non-randomized studies

Plain abdominal X-rays

The majority of urinary tract stones are calcium-containing and should be visible on plain radiography. There is a high specificity but low sensitivity with this technique, reflecting extraneous features including gas shadows, extrarenal calcification, radiolucent calculi and patient habitus. A low sensitivity, ranging from 45% to 58%, has been demonstrated in studies, including some using CT as the reference standard.⁴ In Kang *et al.*'s study, 75 radiographs were assessed by four readers blinded to the presence or absence of urinary calculi.⁵ The radiographs were reviewed in the conventional display, reversed display and a combination of conventional and reversed displays. The authors concluded that the reversed display of soft-copy abdominal radiographs may be useful for detecting urinary calculi.

Ultrasound

The safety and ease of ultrasound examination is unsurpassed but its accuracy is low. Reported sensitivities range from 37% to 64% for calculus detection and 74% to 85% for detection of acute obstruction.^{6,7} When CT scanning is used as the reference standard, the sensitivity can be as low as 24%, with a specificity of 90%.⁸

Non-contrast helical CT scanning (spiral)

This technique has superior sensitivity and specificity over all other modalities. Greater than 99% of stones, including radiolucent stones, on plain X-ray will be seen on spiral CT scanning.⁹ In a study of 100 consecutive patients with flank pain/renal colic, spiral CT scanning was shown to have 96% sensitivity and 99% specificity in detecting ureteric calculi.¹⁰ In a prospective study of 44 patients presenting with acute flank pain, non-enhanced helical CT scanning detected 22 of 23 ureteric calculi (sensitivity 96%) compared with 14 of 23 detected on ultrasound examination (sensitivity 61%). Specificity for each technique was 100%.¹¹

In patients with a first episode of suspected nephrolithiasis, CT scanning should be performed, as it increases

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diagnostic certainty by identifying alternate diagnoses not suspected on clinical grounds alone.¹²

Raptopoulos and McNamara compared CT using a small IV contrast material dose, hydration and high-resolution multidetector CT with conventional helical CT.¹³ Ninety-nine patients were consecutively enrolled in the study and the authors concluded that the combination of hydration, low-contrast dose and the high-image resolution achieved with multidetector CT significantly improves calyceal visualization in CT urography.¹³

Sixty-four patients were assessed for acute ureteric calculus obstruction using unenhanced spiral CT and the combination of HASTE magnetic resonance urography (MRU) and abdominal radiograph. Sensitivities for MRU and CT for the combination of fluid and ureteric dilation were 93% and 95%, respectively, and accuracies were 93% versus 95%, respectively. The authors concluded that MRU/Kidney, Ureter and Bladder X-ray using HASTE sequences and spiral CT are comparable in their accuracy of detecting acute calculus ureteric obstruction. MRU/Kidney, Ureter and Bladder was more accurate than CT in detecting evidence of obstruction such as perirenal fluid.¹⁴

Non-contrast CT was used to assess 129 patients with flank pain and stone disease. The investigators were able to differentiate between uric acid and calcium oxalate stones using peak attenuation measurements and the attenuation/size ratio (>80) of urinary calculi from non-contrast CT.

Patlas *et al.* prospectively examined 62 consecutive patients who presented with flank pain using ultrasound and CT.¹⁵ The sensitivities for ultrasound and CT were 93% and 91%, respectively. The specificities for both were 99%. In consideration, cost and radiation, the authors concluded that ultrasound should be used initially unless ultrasound is unavailable or non-diagnostic.¹⁵

A review by Heidenreich *et al.* found that studies of unenhanced helical CT showed a sensitivity and specificity ranging from 98% to 100% for assessing acute flank pain.¹⁶ This procedure identifies extrarenal causes of flank pain in approximately one-third of patients with acute flank pain.¹⁶

In a study by Karabazoglu *et al.*, 45 patients with obstructive uropathy were examined by ultrasonography, IV urography and diuretic-enhanced excretory MRU by using magnetic resonance contrast agent.¹⁷ MRU provided a high accuracy rate for the diagnosis of obstructive uropathies (92.8% for stone diseases and 100% for other causes of obstructive uropathy).¹⁷

SUMMARY OF THE EVIDENCE

There are no randomized controlled trials on this topic. However, several studies assessing the diagnostic value of radiological techniques are available to direct the choice of imaging. Studies have also assessed the usefulness of unenhanced helical CT, recently introduced as an imaging modality with high sensitivity and specificity for the evaluation of flank pain.

WHAT DO THE OTHER GUIDELINES SAY?

Kidney Disease Outcomes Quality Initiative: No recommendation.

UK Renal Association: No recommendation.

Canadian Society of Nephrology: No recommendation.

European Best Practice Guidelines: No recommendation.

INTERNATIONAL GUIDELINES

No recommendation.

IMPLEMENTATION AND AUDIT

No recommendation.

SUGGESTIONS FOR FUTURE RESEARCH

No recommendation.

CONFLICT OF INTEREST

John Richmond has no relevant financial affiliations that would cause a conflict of interest according to the conflict of interest statement set down by CARI.

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