
Diagnostic performance of low-dose CT for the detection of urolithiasis: a meta-analysis

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CRD summary

This review evaluated the diagnostic accuracy of low-dose computed tomography (CT) for diagnosis of urolithiasis. It concluded that low-dose CT can be used as the initial imaging technique in patients with suspected urolithiasis, although this approach had limitations, especially in obese patients. The conclusions appeared appropriate given the evidence presented, although there could have been unidentified unpublished evidence.

Authors' objectives

To evaluate the diagnostic accuracy of low-dose computed tomography (CT) for the diagnosis of urolithiasis.

Searching

MEDLINE via PubMed and The Cochrane Library databases were searched from 1995 to 2007 to identify relevant articles published in English, German or French. Search terms were reported. References of retrieved articles were cross-checked for further relevant publications.

Study selection

Studies comparing low-dose CT (<3 mSv effective dose) against normal-dose CT or a multi-technique strategy reference standard reporting complete 2x2 contingency table data (or data which could be used to calculate this) were eligible for inclusion in the review.

Included studies used either helical single-detector CT or multi-detector CT (MDCT) for image acquisition. Reference standards included: standard-dose CT; excretory urography and follow-up; retrograde ureteropyelography with or without ureteropyeloscopy; direct visualisation of the calculus after loss/removal with clinical and imaging follow-up; or reports of surgical procedures with confirmation by radiologic examination. Participants were predominately male (mean age 44 years to 51.39 years).

Two reviewers independently assessed studies for inclusion, with disagreements resolved by consensus.

Assessment of study quality

Two radiologists independently assessed the validity of included studies using the STARD checklist (STAndards for the Reporting of Diagnostic accuracy studies).

Data extraction

Data were extracted on key study characteristics, including the number of true positive, true negative, false positive and false negative findings for each low-dose CT study. Where these values were zero, 0.5 was added to each cell of the contingency table to permit the calculation of sensitivity and specificity values.

The authors did not state how many reviewers performed the data extraction.

Methods of synthesis

Sensitivity and specificity values and 95% confidence intervals (CIs) were pooled using the DerSimonian and Laird random-effects model. Statistical heterogeneity was evaluated using the X^2 test. Overall diagnostic performance was determined by constructing summary receiver operating characteristic (SROC) curves and calculating the area under the curve (AUC).

Results of the review

A total of seven studies (n=1,061) were included in the meta-analysis. The median STARD quality score was 0.72 (range 0.62 to 0.95).

Both sensitivity and specificity values for low-dose CT were statistically homogeneous; sensitivity $p=0.9$ and specificity $p=0.615$.

The overall pooled sensitivity was 0.966 (95% CI: 0.950, 0.978). Overall pooled specificity was 0.949 (95% CI: 0.920, 0.970)

The AUC was 99.32 per cent (standard error 0.0016)

Authors' conclusions

A low-dose CT protocol can be used as the initial imaging technique in the workup of patients with suspected urolithiasis, although this approach has limitations relative to standard-dose CT, especially in obese patients.

CRD commentary

The review question was clearly defined in terms of terms interventions, reference standards and outcomes of interest. Attempts were made to minimise bias in the selection and validity assessment of primary studies. Since the sROC curve presented in the review indicated no evidence for a threshold effect, and the included sensitivities and specificities were not statistically heterogeneous, the authors' decision to pool the values appeared appropriate. The search for relevant studies included multiple data sources and languages of publication, though it was not clear whether any attempts were made to identify unpublished studies and the potential for publication bias cannot be ruled out. Validity was assessed according to a published checklist for the reporting of diagnostic studies, but it was not clear how the actual scores presented in the review related to this checklist and unclear how the scores were used in the synthesis. Details of individual studies presented in the review were limited. The authors' conclusions appeared appropriate given the evidence presented, but the possibility of there being further unidentified unpublished evidence could not be excluded.

Implications of the review for practice and research

Research: The authors stated that further research was needed to establish the performance of low-dose CT in the detection of urolithiasis at different noise levels.

Practice: The authors stated that low-dose CT protocols seemed most valuable in patients requiring follow-up scanning to ensure the highest accuracy.

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