BET 4: INVESTIGATING FLANK PAIN: CAN THE CT STAY LOW?

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ABSTRACT

A short cut review was carried out to establish whether low dose CT can be used successfully in the diagnosis of renal tract disease in the ED. 280 papers were found using the reported search, of which 7 represent the best evidence to answer the clinical question. The author, date and country of publication, patient group studied, study type, relevant outcomes, results and study weaknesses of these best papers are tabulated. The clinical bottom line is that unenhanced low dose CT can be used effectively in the investigation of suspected renal colic.

CLINICAL SCENARIO

A 35-year-old male patient attends the emergency department with acute onset pain in the left flank that is constant and radiating anteriorly. You speak to the radiologist to request a non-contrast CT scan to identify the cause of his pain, but the request is declined on grounds that the radiation dose is high and not justified and other imaging is advised. You wonder whether a dose reduction is possible and propose a bet to methodically examine the literature.

THREE-PART QUESTION

In (patients presenting with acute flank pain to the emergency department) can a (low dose CT scan) reliably diagnose (urinary tract stone disease)?

SEARCH STRATEGY

Medline and Embase using NHS Evidence interface week 12 December 2011 ((Exp RENAL COLIC/) OR (renal AND colic)ti.ab OR (ureter* and colic)ti.ab OR (exp URETERAL CALCULI/) OR (urinary and calcul*)ti.ab OR (exp URINARY CALCULI/) OR (kidney AND calculi)ti.ab OR (exp KIDNEY CALCULI/) OR (flank AND pain)ti.ab OR (exp FLANK PAIN/)) AND ((computed AND tomography)ti.ab OR (exp TOMOGRAPHY, X-RAY COMPUTED/) OR (exp TOMOGRAPHY, SPIRAL COMPUTED/) OR (ct AND scan) ti.ab) AND ((low AND dose)ti.ab OR (exp RADIATION DOSAGE/)).

SEARCH OUTCOME

Two hundred and eighty articles were identified. Twenty-two were deemed directly relevant and their abstracts were reviewed. Seven articles were selected for the final critical appraisal. One meta-analysis and two prospective comparative studies provided highest level of evidence. All seven articles are summarised below in table 3.

Table 3 Investigating flank pain: can the CT stay low?

Author, date, country	Patient group	Study type (level of evidence)	Outcomes	Key results	Study weaknesses
Niemann *et al*, 2008, Switzerland	1001 patients in total	Meta-analysis of 6 studies	Sensitivity	0.97 (0.95–0.98)	One article later removed from the analysis
			Specificity	0.95 (0.92–0.97)	
			Accuracy	98.95%	
Kim *et al*, 2005, Korea	M 79, F 42; age 19–86, mean 44; prevalence urolithiasis 87.9%, other diagnoses 7.4%	Prospective comparative	Sensitivity	93–95%	Spectrum bias
			Specificity	86%	
			Sensitivity (for stone <2 mm)	68–79%	
			Positive predictive value	98–99%	
			Negative predictive value	63–71%	
Poletti *et al*, 2007, Switzerland	M 87, F 38; age 19–80 years, mean 45 years; BMI <18.5=9%, 18.5–24.9=27%, 25–29.9=10%, >30=10%; prevalence urolithiasis 80.8%, other diagnoses 4.8%	Prospective comparative	Sensitivity	97%	Spectrum bias
			Specificity	96%	
			Positive predictive value	99%	
			Negative predictive value	88%	
Hamm *et al*, 2002, Germany	M 76, F 33; age 20–84 years, mean 49 years; prevalence urolithiasis 73%, other diagnoses 13.7%	Prospective comparative	Sensitivity	96%	Spectrum bias, unclear selection criteria, delay between index and reference test, partial verification
			Specificity	97%	
			Positive predictive value	99%	
			Negative predictive value	90%	
Mulkens *et al*, 2007, Belgium	LDCT group: M 97, F 53; age 18–87 years, mean 50.23; BMI 24.87 SDCT group: M 91, F 59; age 22–90 years, mean 52.5; BMI 26.71; prevalence urolithiasis 52.7%, other diagnoses 15–16%	Prospective quasi randomised consecutive, 87% from ED	LDCT sensitivity	96.0–98.6%	Unclear selection criteria, inappropriate reference test, delay in index and reference test, partial verification
			Specificity	90.2–93.5%	
			Positive predictive value	90.6–93.5%	
			Negative predictive value	95.8–98.6%	
			SDCT sensitivity	93.7–98.8%	
			Specificity	94.2–98.4%	
			Positive predictive value	93.7–96.4%	
			Negative predictive value	94.2–98.4%	
Kluner *et al*, 2006, Germany	M 74, F 68; age 18–83 years, mean 47; prevalence urolithiasis 72%, other diagnoses 14.8%	Prospective comparative	Sensitivity	97% (92–99%)	Spectrum bias, inappropriate reference test, unclear selection criteria, delay in index and reference test, partial verification, 59% lost to follow-up
			Specificity	95% (83–99%)	
			Positive predictive value	98%	
			Negative predictive value	93%	
Tack *et al*, 2003, Belgium	M 53, F 53; age 15–84 years, mean 45; mean BMI 26.2; prevalence urolithiasis 36%, other diagnoses 12%		Sensitivity	90–95%	Unclear selection criteria, inappropriate reference test, delay in index and reference test, partial verification
			Specificity	90–100%	
			Positive predictive value	94–100%	
			Negative predictive value	93–98%	

COMMENTS

Urinary stone disease is one of the more common causes of flank pain. Studies that have reported significant alternative diagnoses are based on the use of unenhanced CT, considered as the gold standard for investigation. Even though it is a better investigation, there are concerns regarding the level of radiation exposure with a CT scan. Some patients may need multiple scans and may receive a substantial dose of radiation. Katz *et al* reported a mean effective radiation dose of 8.5 mSv for multi-detector CT. Significantly, 176 patients needed multiple scans reaching the maximum dose of 154 mSv. The lifetime attributable risk of developing cancer is generally 1/10 000 for every 10 mSv of radiation exposure, average across all ages and gender. However, for patients <30 years of age lifetime attributable risk is 10/10 000. Therefore it is essential to reduce the dose of radiation exposure. But that should not compromise with diagnostic quality. Over the last decade, the dosage of radiation for CT scans has gradually reduced and some of the CT examinations can now be done with a low dose, typically less than 3 mSv per examination. Liu *et al* were first to report the use of low dose CT (LDCT) in 2000, however their calculation of the radiation dose was incorrect and the paper was later retracted. Niemann *et al* later excluded this paper from their meta-analysis. There were a total of 1001 patients. Pooled sensitivity and specificity were 0.965 (95% CI 0.949 to 0.978) and 0.949 (95% CI 0.918 to 0.970), respectively. The accuracy of the test reflected by the area under the summary receiver operating curve was 98.95% (SE 0.0032). Kim *et al* and Poletti *et al* have directly compared the LDCT with standard dose CT. Both concluded that the investigation has high sensitivity and specificity for diagnosing urolithiasis when the stone size is 2 mm or 3 mm. Given that stones <5 mm have a 68% (95% CI 46% to 85%) chance of spontaneous passage, most clinically significant stones can be diagnosed with this technique. Poletti *et al* reported that the sensitivity falls to 50% for patients with a BMI >30 kg/m^2. This finding has conflicting evidence. While Mulkens *et al* did not find any difference in diagnosing urolithiasis in obese and overweight patients, Hamm *et al* recommended 31 kg/m^2 and Tack *et al* recommended 35 kg/m^2 as the upper limit for doing an LDCT. However the number of obese patients in these studies is very small and therefore these are underpowered to establish any statistically significant result. Barring the three (level 1) studies, the rest have methodological flaws. The main reason is the use of a composite or a weaker reference standard. It will be ethically difficult to justify a study comparing standard dose CT with LDCT as this will mean excessive radiation and therefore a composite standard is used as reference test. However, some of the components of the composite reference standard, like the presence or absence of microscopic haematuria, plain abdominal film or ultrasound scan are of questionable value in diagnosing urolithiasis. Different investigation modalities were applied to different patients, which may have depended on the results of the initial CT scan, making it highly likely that the index test (LDCT) was part of patient workup. The meta-analysis of six studies by Niemann *et al* reported high sensitivity and specificity with LR+ of 18.9 and LR− of 0.04 for the diagnosis of urolithiasis by LDCT.

Clinical bottom line

Unenhanced low dose CT scan can be used for as a first line investigation for the diagnostic workup of patients with suspected renal colic.

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