

Comparative Effectiveness of Imaging Modalities for the Diagnosis of Upper and Lower Urinary Tract Malignancy: A Critically Appraised Topic

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Rationale and Objectives: The purpose of this study was to critically appraise and compare the diagnostic performance of imaging modalities that are used for the diagnosis of upper and lower/bladder urinary tract cancer, transitional cell carcinoma (TCC).

Methods: A focused clinical question was constructed and the literature was searched using the patient, intervention, comparison, outcome (PICO) method comparing computed tomography (CT) urography, magnetic resonance (MR) urography, excretory urography, and retrograde urography in the detection of TCC of the upper urinary tract. The same methods were used to compare CT cystography, MR cystography, and ultrasonography in the diagnosis of bladder cancer. Retrieved articles were appraised and assigned a level of evidence based on the Oxford University Centre for Evidence-Based Medicine hierarchy of validity for diagnostic studies.

Results: The retrieved sensitivity/specificity for the detection of TCC of upper urinary tract for CT urography, MR urography, excretory urography, and retrograde urography were 96%/99%, 69%/97%, 80%/81%, and 96%/96%, respectively. For detecting bladder cancer, the retrieved sensitivity/specificity for CT cystography, MR cystography, and ultrasonography were 94%/98%, 91%/95%, and 78%/96%, respectively.

Conclusions: CT urography is the best imaging technique for confirming or excluding malignancy in the upper urinary tract, whereas CT cystography has the best diagnostic performance for diagnosing bladder cancer.

Key Words: Evidence-based medicine; upper urinary tract; lower urinary tract; cancer; bladder cancer; transitional cell carcinoma; diagnosis; sensitivity and specificity; confidence interval; positive predictive value; negative predictive value; likelihood ratio.

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Transitional cell carcinoma of the renal pelvis and ureter account for 7% of kidney tumors and 4% of upper urinary tract tumors, respectively (1). This cancer has a greater than 90% cure rate if superficial and confined to the renal pelvis and ureter (1). For more invasive tumors, the cure rate drops to 10%–15% (1). Current standard diagnostic modalities for evaluation of upper urinary tract malignancy include computed tomography urography (CTU) or excretory urography. If the patient has a contraindication to intravenous iodinated contrast media, retrograde urography

or gadolinium enhanced magnetic resonance urography (MRU) are alternative options (2,3).

Bladder cancer will account for an estimated 73,510 new cases and 14,880 deaths in the United States in 2012 (4). Cystoscopy is the gold standard of diagnosing bladder cancer; however, it is an invasive technique (5). CT cystography (CTC) and MR cystography (MRC) are less invasive new modalities that have been proposed in the assessment of bladder cancer (5).

ASK

We questioned whether CTU, MRU, excretory urography, or retrograde urography perform better in the diagnosis of upper urinary tract transitional cell carcinoma. Before undertaking this review using evidence-based methods, we noted the prevailing popular opinion (before using explicit critical appraisal) that CTU is more accurate than MRU in the diagnosis transitional cell carcinoma. Similarly for bladder cancer, we questioned whether the noninvasive diagnostic methods

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Upper Urinary Tract			
Patients	Interventions	Comparisons	Outcome
(Upper Urinary Tract	Magnetic Resonance	Excretory Urography	Diagnosis
OR	Urography	OR	OR
Upper Urogenital System)	OR	Excretory Pyelography	(Sensitivity
	MR Urography	OR	AND
AND	OR	Intravenous Pyelography	Specificity)
	AND MRU	AND OR	AND
(Cancer	OR	Intravenous Urography	
OR	Computed Tomography	OR	
Carcinoma	Urography	IV Pyelography	
OR	OR	OR	
Malignancy	CT Urography	IV Urography	
OR	OR	OR	
Neoplasm)	CTU	IVP	
		OR	
		IVU	
		OR	
		Retrograde Urography	
		OR	
		Retrograde Pyelography	
Lower Urinary Tract			
Patients	Interventions	Comparisons	Outcome
Bladder	Magnetic Resonance	Ultrasound	Diagnosis
AND	Cystoscopy	OR	OR
(Cancer	OR	Ultrasonography	(Sensitivity
OR	MR Cystoscopy	OR	AND
Carcinoma	OR	Sonography	Specificity)
OR	AND Magnetic Resonance	AND	AND
Malignancy	Virtual Cystoscopy		
OR	OR		

Figure 1. Search strategy using PICO (patient, investigation, comparison, outcome)-focused keywords.

such as CTC, MRC, or ultrasound have a better diagnostic performance.

We constructed a focused standardized PICO (patient, investigation, comparison, and outcome) question to search the available literature (6–8) as follows: 1) “In patients with upper urinary tract transitional cell carcinoma, how does CTU vs. MRU vs. retrograde pyelography vs. excretory urography compare with each other for diagnosis?” and 2) “In patients with bladder cancer, how does MRC vs. CTC vs. ultrasonography (US) compare with each other for diagnosis?”

SEARCH

Secondary and primary evidence were searched according to the evidence pyramid described by Haynes et al (9). For secondary literature (eg, information systems, synopses, syntheses) (8), we searched *Up To Date* (10), *The American College of Physicians (ACP) Journal Club* (11), *Cochrane Collaboration Library* (12), *the Turning Research into Practice (TRIP)* (13), and PubMed (14). For primary literature (original studies), we searched PubMed (14) and EMBASE (15). No language restriction was applied. Medical subject headings (MeSH) corresponding to the two clinical questions of the study were used as demonstrated in Figure 1. Databases were searched from inception through to February 07, 2012, with no language limitations. Reference lists from iden-

tified studies were manually scanned to identify other relevant studies.

APPRAISE

Upper Urinary Tract

CTU. On searching the secondary literature (13), we found a meta-analysis entitled “Performance of computed tomographic urography in diagnosis of upper urinary tract urothelial carcinoma, in patients presenting with hematuria: Systematic review and meta-analysis”, published in 2010 (16). This meta-analysis was assigned level IIa evidence using the Oxford Center for Evidence Based Medicine (17). The study addressed a focused clinical question. We appraised this meta-analysis by Chlapoutakis et al (16), using the AMSTAR (assessment of multiple systematic reviews) checklist (18). This study conducted a comprehensive literature search, and it is unlikely that important relevant studies were missed. The quality of included studies in this meta-analysis were assessed and appropriately used in formulating conclusions. The results of this meta-analysis are therefore considered valid. The summary sensitivity and specificity were 96% and 99%, respectively. The authors concluded that CTU has good diagnostic accuracy, but is associated with several drawbacks, including exposure to radiation and contrast media, and cost. However, the authors concluded the CTU is the method of choice for detection of upper

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