

Assessing the Costs of Extraordinary Findings of Computed Tomography Urogram in the Evaluation of Asymptomatic Microscopic Hematuria



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OBJECTIVE	To assess the costs associated with incidental extraordinary findings on computed tomography urogram (CTU) in patients with asymptomatic microscopic hematuria.
MATERIALS AND METHODS	A retrospective review was performed to identify all CTUs performed for asymptomatic microscopic hematuria at our institution from 2012 to 2014. All genitourinary (GU) and incidental extraordinary findings were documented. Further clinical follow-up to May 2015 was reviewed to determine if any referrals, tests, imaging, and/or procedures were ordered based on the initial CTU. Cost estimates were determined using the Medicare physician reimbursement rate.
RESULTS	Two hundred two patients were evaluated with CTU for asymptomatic microscopic hematuria. GU malignancy was documented in 2 patients (0.99%), both renal masses suspicious for renal cell carcinoma. Sixty patients were found to have kidney stones, of which 26 had stones ≥ 5 mm. Incidental extraordinary findings were found in 150 (74.3%) patients, requiring further imaging costs of \$17,242 or \$85.35 per patient screened. Twelve patients required a total of 20 procedures for a cost of \$54,655. The total cost related to extraordinary findings was \$140,290 or \$694.50 per initial patient screened.
CONCLUSION	The incidental extraordinary findings detected on CTU can lead to expensive and invasive testing and treatment. Whereas costs associated with further workup were high, the overall outcomes in both GU and non-GU cancer diagnosis were low. Future analysis should focus on limiting the cost and invasiveness of our evaluation for this condition. UROLOGY 95: 34–38, 2016. © 2016 Elsevier Inc.

Per the American Urological Association guidelines, asymptomatic microhematuria is defined as ≥ 3 RBC/HPF on urine microscopy in the absence of an obvious benign cause. This diagnosis requires an evaluation including a cystoscopy and a form of upper tract imaging.¹ Currently, the recommended imaging test of choice is a computed tomography urogram (CTU) due to its high sensitivity and specificity in detecting genitourinary (GU) malignancies.^{2,3} In a large number of cases (45%–77%), however, the cause of asymptomatic microscopic hematuria (AMH) is not found.^{4–6} Furthermore, previous

studies have shown a low incidence of urologic malignancy (0.43%–5.0%) in patients with AMH.^{4,6–8} Of these, most are bladder or kidney cancer, with 0%–0.1% being upper tract urothelial cancers.^{5,7}

The use of CTU also commonly reveals incidental extraordinary findings of which a small number are clinically significant.^{9–12} This may lead to additional and ultimately negative workups.¹¹ Previous studies have evaluated the costs of incidental CTU findings in the evaluation of gross hematuria.^{9,11,12} We recognize that incidental findings would also be a problem in the evaluation of AMH. Furthermore, the AMH evaluation is commonly negative so detection of incidental findings is even more problematic.

This raises the question if CTU is appropriate for the initial evaluation of AMH in lieu of other imaging modalities such as ultrasound (US). We assessed the costs associated with CTU-detected incidental extraordinary findings in patients with asymptomatic microscopic hematuria and the role of CTU as upper tract evaluation for these patients.

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MATERIALS AND METHODS

We obtained Institutional Review Board approval for our study. We identified all patients who had CTU to evaluate AMH. A search of the radiology report database from October 1, 2012 to September 30, 2014 was performed to include the terms “urogram” and/or “urography”. This search identified 885 total patients.

Of the 885 initial patients, 202 were referred specifically for new onset asymptomatic microscopic hematuria. Any patient referred for GU-related trauma, stones, or infections were excluded. Each radiology report was reviewed and any urinary and extraurinary findings were documented. A urinary finding was defined as any abnormality involving the renal parenchyma, collecting system, ureters, bladder, prostate, or seminal vesicles. Any finding not involving these structures were labeled as extraurinary. An incidental finding was defined as 1 for which the patient had no prior history and was not related to the reason for examination. Non-GU incidental findings were organized per clinical significance. This categorization was based on previous studies that also reviewed incidental findings.^{11,12}

Further clinical follow-up up to May 2015 was also reviewed to determine if any additional referrals, imaging, and/or procedures were ordered based on the initial CTU. If so, cost estimates for each using Current Procedural Terminology coding was determined using Medicare physician reimbursement rates.¹³ All imaging cases were performed at the authors' institution; thus, all costs were facility based. The procedure rates including anesthesia fees are based on inpatient facility-based reimbursement rates. Costs for inpatient care were determined using 2014 Kaiser statistics on hospital-adjusted expenses per inpatient day for nonprofit hospitals in the United States.¹⁴ Any diagnosis of urinary or extraurinary malignancy whether at time of imaging or on follow-up was documented. Costs of the initial CTU were not included in the total costs. The focus of this study was on the costs associated only with incidental findings on CTU. In addition, cost of cystoscopy is not included because it is required to evaluate the bladder independently of the imaging modality used. None of the imaging modalities recommended by the American Urological Association (CTU, US, intravenous pyelogram [IVP]) would be considered adequate to assess bladder malignancy independently in a hematuria workup.

RESULTS

A total of 202 patients fulfilled inclusion criteria for the study. This population included 79 males and 122 females and had a mean age of 55.56 years. Neither age nor gender was significantly associated with the number of incidental findings on CTU. Of the 202 patients, 150 (74.25%) had documented incidental extraurinary findings, whereas 123 (60.9%) had findings involving the urinary tract. There were 23 (11.38%) patients who had no incidental findings.

In the population with GU findings ([Supplementary Table S1](#)), the most common abnormalities were renal cysts (68/172, 39.5%) and nephrolithiasis (60/172, 34.9%). There were 62 patients who had GU findings related to stone disease including 60 with nephrolithiasis and 2 with bladder stones. Of those with nephrolithiasis, 26 had stones ≥ 5 mm and received further imaging. This additional imaging consisted of abdominal x-rays (n = 24) and renal ultrasounds (RUS) (n = 23).

Nonstone GU findings were seen in 92 patients. The most common abnormalities were renal cysts (n = 68) and prostate enlargement (n = 30). Of this population 26 patients received additional imaging including RUS (n = 13) and computed tomography of the abdomen and pelvis with and without contrast (n = 4) ([Supplementary Table S2](#)). None of the cysts on initial CTU or on follow-up imaging were higher than Bosniak stage II; no intervention was required.

There were 13 patients for which GU findings were suspicious for malignancy. Of these, bladder wall thickening was the most common (n = 7) followed by ureteral filling defect (n = 4) and renal lesion (n = 2). On review of the cystoscopies, none of the 202 patients were found to have any observable bladder lesion or malignancy. All of the patients with a ureteral filling defect underwent ureteroscopy (n = 4), of which none showed evidence of malignancy.

GU malignancy was documented in 2/202 patients (0.99%), both consisting of renal masses suspicious for renal cell carcinoma (RCC). Both patients underwent robotic-assisted laparoscopic partial nephrectomies. Final pathology for both cases revealed T1aNxM0 clear cell RCC with tumor size of 1.1 cm and 1.2 cm, respectively. There was 1 case of renal angiomyolipoma, for which the patient elected to undergo observation through his primary care provider.

Incidental extraurinary findings were found in 150 patients and were categorized based on significance ([Table 1](#) and [Supplementary Table S3](#)). High clinically significant findings were found in 30/202 (14.8%) patients. The most common abnormalities were suspicious liver lesions (n = 6), cirrhosis (n = 6), and suspicious adnexal or uterine lesions (n = 4). All 30 of these patients received follow-up imaging including magnetic resonance imaging of the abdomen (n = 8) and computed tomography pre- and postcontrast (n = 10) ([Table 2](#)). Based on imaging, 13 patients required referrals to other specialists, of which most common include gastroenterology (n = 4), OB/GYN (n = 4), and general surgery (n = 3) ([Table 3](#)).

Of this referred population, 12 patients ultimately required a total of 20 procedures for extraurinary findings

Table 1. Incidental extraurinary findings of high clinical significance

Finding	Number of Findings
Cirrhosis	6
Liver lesions (suspicious)	6
Lung nodules	4
Suspicious adnexal/uterine mass	4
Aortic aneurysm >3 cm	3
Biliary dilation	3
Gastrointestinal varices	2
Breast abnormality	1
Colon mass	1
Gallbladder mass	1
Lymphadenopathy >3 cm	1
Mesenteric panniculitis	1
Pleural effusion	1
Retroperitoneal mass	1
Superior mesenteric artery stenosis	1
Small bowel malrotation	1

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