CLINICAL RESEARCH STUDY

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Evaluating Hematuria: Impact of Guideline Adherence on Urologic Cancer Diagnosis

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ABSTRACT

PURPOSE: The purpose of this study was to assess physician adherence to 2001 American Urological Association (AUA) guidelines for evaluating patients with asymptomatic hematuria and its impact on the diagnosis of urologic cancer.

METHODS: In this institutional review board-approved retrospective study of patients with asymptomatic hematuria evaluated in a large academic health center in 2004 (allowing for long-term follow-up), we randomly selected 100 of 1771 patients with asymptomatic hematuria (52 men; mean age 54 years; 58 microscopic, 39 macroscopic, three unknown-type hematuria; median follow-up 89 months, interquartile range 33-97 months). Multivariate logistic regression assessed effects of age, sex, hematuria type, and physician specialty on guideline adherence, the primary outcome. Secondary outcome measures were variability in evaluation among physician specialists, and the proportion of patients developing urologic cancer.

RESULTS: Only 36 of 100 patients had a guideline-adherent evaluation, of which 5 were diagnosed with urologic cancer (median 1 month, range 0-11). No urologic cancers were diagnosed in 64 patients with nonadherent evaluations. Only evaluation by a urologist significantly predicted guideline adherence ($P < .0001$). Patients with gross hematuria more often underwent intravenous or computed tomography urography ($P = .009$); urologist evaluation more often led to intravenous or computed tomography urography ($P < .0001$), cystoscopy ($P < .0001$), cytology ($P = .009$), and guideline-adherent evaluation ($P < .0001$).

CONCLUSIONS: Although most physicians did not adhere to 2001 AUA guidelines when evaluating patients with asymptomatic hematuria, no urologic cancers were diagnosed in patients without guideline-adherent evaluation, barring the possibility of occult cancers. Evaluation by a urologist was the only predictor of a guideline-adherent evaluation. Future studies are needed to determine the optimal evaluation of patients with asymptomatic hematuria.

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KEYWORDS: Adherence to guidelines; Diagnostic evaluation; Hematuria; Variability in practice

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Asymptomatic hematuria is common in clinical practice, with a prevalence ranging from 0.18% to 38.7%.[1-12] Both gross and microscopic forms can arise from any site in or near the urinary tract, and even when intermittent, can be the only sign of a serious disease, including malignancy. However, hematuria is more commonly due to benign diseases such as infection, urolithiasis, benign prostatic hyperplasia, or clinically insignificant causes (eg, menses, exercise). The evaluation of hematuria, particularly when microscopic, fails to reveal a cause in 8%-61% of patients.[7-11] As a result, the cost-effective, medically appropriate diagnostic approach to asymptomatic hematuria is controversial.

Evidence-based data are lacking regarding the optimal choice, timing, and frequency of diagnostic tests for evaluating patients with hematuria. Therefore, variability exists among published professional society guidelines that rely

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mainly on literature review and expert consensus.[1,3,12-17] While rising health care costs[18] and increasing medical radiation exposure[19-22] are driving factors to limit utilization of diagnostic imaging tests, the desire to diagnose all cancers persists. Hence, in general, the most important clinical concern when evaluating patients with hematuria is diagnosing a urologic cancer at an early, treatable stage. Indeed, of 40 lawsuits between 2002 and 2012 related to missed or delayed diagnosis of renal or bladder cancer due to an inadequate hematuria evaluation, 15 (38%) led to substantial payments.[23]

Among the published guidelines,[1,3,12-17] those of the American Urological Association (AUA) provide specific recommendations and are most likely to be followed by urologists, internists, and other physicians who encounter patients with hematuria in the US. In 2012, the 2001 AUA guidelines were revised.[3,14] The time interval between them provided an opportunity to study the impact of the 2001 guidelines on the evaluation of patients with hematuria and allowed a long follow-up interval to identify all patients who developed urologic cancer. Therefore, the purpose of this study was to assess physician adherence to the 2001 AUA guidelines for evaluating patients with asymptomatic hematuria and its impact on the diagnosis of urologic cancer.

CLINICAL SIGNIFICANCE

- Most physicians did not adhere to published guidelines when evaluating asymptomatic hematuria.
- Substantial variability exists in evaluating asymptomatic hematuria by type of hematuria (gross vs microscopic) and physician specialty; only evaluation by a urologist predicted guideline adherence.
- All patients diagnosed with urologic cancer (5% of total cohort) underwent guideline-adherent evaluation, however, an occult cancer may have been present in patients not undergoing guideline-adherent evaluation.

METHODS

Study Setting and Subjects

In this institutional review board-approved, Health Insurance Portability and Accountability Act-compliant, retrospective cohort study, informed consent was waived. The study site was a large academic health center. Electronic medical records were searched for patients presenting with an onset of hematuria in 2004, a period selected to allow for long-term follow-up.

Our institution's Research Patient Data Registry query tool identified 1771 ambulatory and inpatients aged 18 years or older with a principal or secondary International Classification of Diseases, 9th edition, Clinical Modification (ICD9-CM) diagnosis code of hematuria (599.70, 599.71, or 599.72). These ICD9-CM codes excluded patients with insignificant causes of hematuria (eg, menstruation, exercise).

A sample size calculation for 95% confidence level and 10% confidence interval for the primary outcome measure, adherence to AUA guidelines, yielded a sample size of 91 and therefore we aimed for 100 patients. To select the sample, we randomly ordered the 1771 patients identified by the Research Patient Data Registry query tool and from these, selected 100 consecutive patients who met inclusion criteria of initial presentation of asymptomatic hematuria in 2004, electronic medical records available for review, and hematuria not due to causes such as menstruation, exercise, trauma, or infection, as documented in the electronic medical records (**Figure 1**). In addition, 40 patients were selected for a pilot study of the data collection form.

Chart Review

Data were collected in all 100 patients from 2004 through 2012, including: patient age, sex, date of first presentation of hematuria, type (gross or microscopic), specialty of physician initially evaluating hematuria, and risk factors for urologic cancers included in the guidelines.[3,14] Risk factors included age over 40 years, gross hematuria, history of cigarette smoking, occupational exposure to chemicals or dyes, history of urologic disorder, irritative voiding symptoms, urinary tract infection, pelvic irradiation, or analgesic abuse.[3,14] We also studied the number and types of diagnostic tests utilized in the hematuria evaluation, including urinalysis, upper urinary tract imaging, urine cytology, and cystoscopy. The type of imaging (radiography, intravenous urography, computed tomography [CT], ultrasonography, or magnetic resonance imaging) and protocols used (CT urography or magnetic resonance urography) were noted. All urologic malignancies (defined as renal, ureteral, bladder, urethral, and prostate cancers) developing during the follow-up period, as well as survival information, were recorded.

Pilot Study

During the pilot study, we learned that the presence or absence of some risk factors could not be extracted reliably from the electronic medical records; absence of documentation of a risk factor was not considered reliable unless the chart explicitly stated it was absent. The only risk factors reliably documented were age and presence of gross hematuria. Therefore, further data collection was limited to these risk factors. Other risk factors were recorded, when available, for the purpose of risk stratification, but were excluded from other analyses.

Guideline Adherence

The 2001 AUA guidelines divided patients into high- and low-risk categories based on presence or absence of risk factors enumerated above. For high-risk patients, defined as

having one or more risk factors and 3 or more red blood cells per high power field on a single urinalysis, a complete evaluation, including upper tract imaging, urine cytology, and cystoscopy, was recommended. For low-risk patients, those with no risk factors and 3 or more red blood cells per high power field on 2 of 3 urinalyses, upper tract imaging, followed by urine cytology or cystoscopy, was recommended. Cystoscopy was recommended for patients with positive, atypical, or suspicious urine cytology. For the purpose of assessing guideline adherence, diagnostic examinations performed within 6 months after the detection of hematuria were considered part of the initial evaluation.

Subjects

The final study population included 52 men and 48 women with a mean age of 54 years (range 20-91 years); 17 patients were younger than 40. Most (n = 58) patients had microscopic hematuria; 39 had gross hematuria; in 3 patients, hematuria type was unknown.

The median follow-up interval was 89 months (interquartile range 33-97 months); all but 13 patients had follow-up of 1 year or more. A total of 10 patients had a preexisting malignancy, including prostate cancer in 4 patients, and breast cancer, renal cell carcinoma, pancreatic cancer, lung cancer, neuroblastoma, and thyroid cancer in one patient each.

Statistical Analyses

To assess factors affecting the evaluation, we divided patients into groups by sex (men vs women), age ($<$ vs $\geq$40 years), prior history of malignancy (present vs absent), hematuria type (gross vs microscopic), or physician specialty (urologist vs nonurologist). The following were compared between these subgroups: physician specialty, whether or not upper tract imaging was performed, whether or not intravenous urography or CT urography was obtained, whether or not cystoscopy was performed, whether or not urine cytology was performed, and whether the evaluation was guideline adherent. Fisher's exact test was used for all comparisons. Potential predictors of guideline adherence, including sex, age, hematuria type, and physician specialty, were assessed using a multivariate logistic regression model. Statistical analyses were performed with Statistical Analysis Software version 9.2 (SAS Institute Inc, Cary, NC). A P-value $<.05$ was considered statistically significant. All P-values were 2-sided.

RESULTS

Diagnostic Evaluation

Hematuria was evaluated initially by urologists in 18 patients, and nonurologist physicians in the remaining 82 patients (primary care physician in 65; gynecologist in 5; medical oncologist in 3; psychiatrist, cardiologist, and neurologist in 2 each; and pulmonologist, infectious disease specialist, and radiation oncologist in one patient each). Urinalysis was the most common diagnostic test, utilized in all 100 patients. Of these, 55 patients underwent one or more urinalyses at an outside institution shortly before presenting to our institution and had only one urinalysis at initial presentation to our institution. The remaining 45 patients underwent 2 or more urinalyses at our institution at the initial presentation. Imaging was obtained during the initial evaluation in 76 patients (Table 1, Figure 2). Forty-three patients had urine cytology. Cystoscopy was performed in 35 patients: in all 18 patients evaluated by urologists, and in 17 of 22 patients referred to urologists after initial evaluation by nonurologists. Of the 5 patients who were referred to a urologist but did not undergo cystoscopy, 4 were younger than 40 years and underwent urine cytology. One patient had a renal angiomyolipoma detected with CT and a decision was made not to perform cystoscopy after the CT finding was discussed with the patient.

Adherence to 2001 AUA Guidelines

Of 100 patients, 36 underwent a guideline-adherent evaluation. Of all 100 patients, 91 were in the high-risk category. Of the 91 high-risk patients, 33 (36.3%) underwent guideline-adherent evaluation, as compared with 3 (33.3%) of 9 low-risk patients. There was no difference between the high- and low-risk groups in terms of physician specialty, imaging, cystoscopy, and urine cytology utilization, or adherence to the guidelines (Table 2).

Among 64 patients with a nonadherent evaluation, both upper tract imaging and cystoscopy were not performed in 23 (36%) patients, cystoscopy alone was not performed in 40 (63%) patients, and upper tract imaging alone was not performed in one (1%) patient; urine cytology was not performed in 56 patients.

Variability in Hematuria Evaluation

There were no differences in the evaluation of hematuria according to age, sex, or prior history of malignancy

Table 1 Diagnostic Tests Used during Initial and Subsequent Evaluation of 100 Patients with Asymptomatic Hematuria

Modality	Initial Evaluation (Number of Patients)	Follow-up Period (Number of Patients)	Total Number of Tests
Urinalysis	100	49	476
Imaging	76*	23	101
	47 CT	14 CT	
	24 Ultrasound	9 Ultrasound	
	4 Radiography		
	3 MRI		
Urine cytology	43	17	96
Cystoscopy	35	8	53

CT = computed tomography; MRI = magnetic resonance imaging.
*Two of four patients who underwent radiographic studies also had contrast-enhanced abdominal CT.

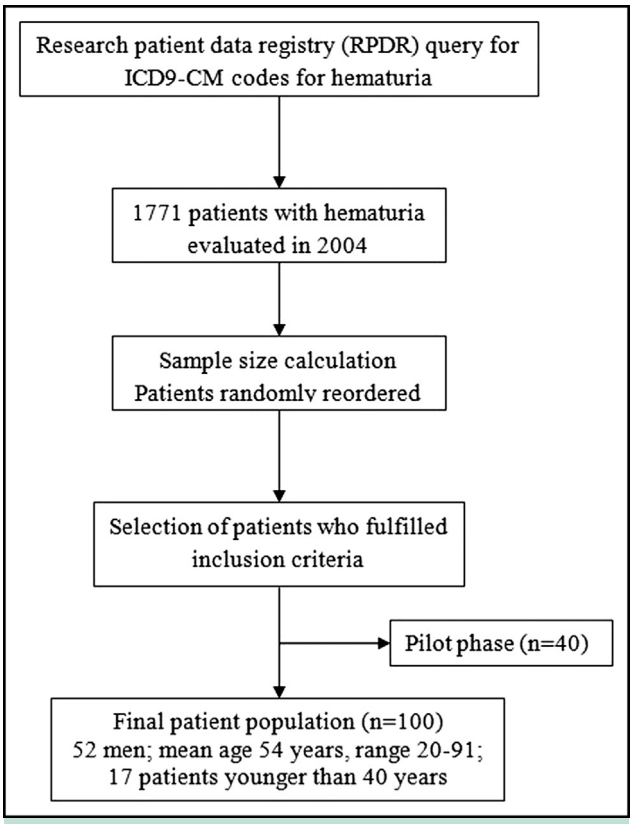

Figure 1 Flow chart showing how patient population was derived to study physician adherence to 2001 American Urological Association guidelines on the evaluation of asymptomatic hematuria. ICD9-CM = International Classification of Diseases, 9th Revision, Clinical Modification.

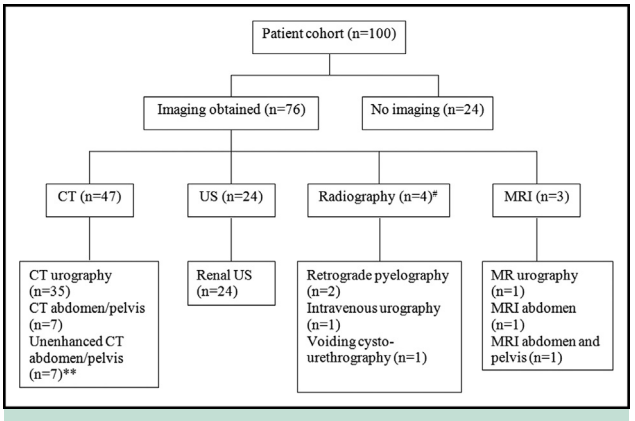

Figure 2 Flow chart showing imaging utilization in patients during initial evaluation of hematuria.*
*Within 6 months of initial presentation at our institution.
**Two patients had 2 computed tomography (CT) scans each during their initial evaluation; one had CT urography and contrast-enhanced abdominal CT, one had CT urography and unenhanced abdominal CT.
#Two of 4 patients who underwent radiographic studies also had contrast-enhanced abdominal CT.
MRI = magnetic resonance imaging; US = ultrasonography.

Table 2 Differences in the Diagnostic Evaluation of Asymptomatic Hematuria Based on Risk Category (n = 100 Patients)

Parameter	High Risk (n = 91)	Low Risk (n = 9)	*P*-Value
Evaluation by urologist	17 (19%)	1 (11%)	.69
Imaging utilized (all modalities)	68 (75%)	8 (89%)	.45
IVU or CTU	33 (36%)	3 (33%)	1
Cystoscopy	34 (37%)	1 (11%)	.16
Urine cytology	40 (44%)	3 (33%)	.73
Adherence to guidelines	33 (36%)	3 (33%)	1

All *P*-values represent Fisher's exact test.
IVU or CTU = Intravenous urography or computed tomography urography.

(Table 3). Patients with gross hematuria were more likely to undergo upper tract imaging (CT urography or intravenous urography), as recommended by the guidelines ($P = .009$); however, there were no differences between those with and without gross hematuria in terms of guideline adherence. Patients evaluated by urologists were more likely to undergo upper tract imaging ($P < .0001$), cystoscopy ($P < .0001$), and have a guideline-adherent evaluation ($P < .0001$). Nonurologist physicians were more likely to obtain renal ultrasound than urologists ($P = .002$). In fact, all 24 ultrasounds were requested by nonurologists. After controlling for all variables, evaluation by a urologist was the only significant predictor of a guideline-adherent evaluation ($P < .0001$; odds ratio 54.7; 95% confidence interval, 10-102; Hosmer-Lemeshow goodness-of-fit test, $P = .6$). Patient sex ($P = .95$), age ($P = .81$), and type of hematuria ($P = .66$) did not affect guideline adherence.

Urologic Cancer Diagnoses

Urologic cancer was detected in 5 patients (median 1 month after presentation; range, 0-11 months), all among 36 patients who underwent a guideline-adherent evaluation (14%, 5/36). Urologic malignancies included bladder cancer (n = 3), and renal cell carcinoma and prostate cancer (n = 1 each). Urologic malignancies were more common in patients with gross hematuria ($P = .009$), and more frequently detected in those evaluated by urologists ($P = .04$). No urologic malignancies were diagnosed in the 64 patients whose evaluation was non-guideline adherent. In addition, 33 other urinary tract abnormalities were detected in 26 patients, including renal cysts (n = 13), urolithiasis (n = 11), cystitis (n = 4), and an angiomyolipoma (n = 2). A renal infarct, cystocele, and a benign calyceal mass were diagnosed in one patient each. None of the patients with negative imaging and cystoscopy had positive urine cytology. Of the 10 patients with prior malignancies, one patient was diagnosed with bladder cancer, one with renal cysts and a bladder diverticulum, and 2 with renal cysts.

A total of 23 patients underwent imaging during the follow-up period. Of these, 18 patients had undergone imaging during the initial evaluation of hematuria, and

Table 3 Differences in the Diagnostic Evaluation of Asymptomatic Hematuria Based on Patient Age, Sex, Prior History of Malignancy, Hematuria Type, and Physician Specialty (n = 100 patients)

	Parameter			*P*-Value
Differences in evaluation by age		Age >40 (n = 89)	Age ≤40 (n = 11)	
	Evaluation by urologist	17 (19%)	1 (9%)	.68
	Imaging utilized (all modalities)	67 (75%)	9 (82%)	1
	IVU or CTU	32 (36%)	4 (36%)	1
	Cystoscopy	33 (37%)	2 (18%)	.32
	Urine cytology	38 (43%)	5 (45%)	1
	Adherence to guidelines	21 (24%)	4 (36%)	.46
Differences in evaluation by sex		Men (n = 52)	Women (n = 48)	
	Evaluation by urologist	10 (19%)	8 (17%)	.80
	Imaging utilized (all modalities)	40 (77%)	36 (75%)	1
	IVU or CTU	22 (42%)	14 (29%)	.21
	Cystoscopy	20 (38%)	15 (31%)	.53
	Urine cytology	22 (42%)	21 (44%)	1
	Adherence to guidelines	20 (39%)	16 (33%)	.68
Differences in evaluation by prior history of malignancy		No prior malignancy (n = 90)	History of malignancy (n = 10)	
	Evaluation by urologist	16 (18%)	2 (20%)	1
	Imaging utilized (all modalities)	71 (79%)	5 (50%)	.06
	IVU or CTU	34 (38%)	2 (20%)	.32
	Cystoscopy	31 (34%)	4 (40%)	.74
	Urine cytology	38 (42%)	5 (50%)	.74
	Adherence to guidelines	33 (37%)	3 (30%)	1
Differences in evaluation by type of hematuria	Parameter	Microscopic Hematuria (n = 58)	Gross hematuria (n = 39)	
	Evaluation by urologist	8 (14%)	10 (26%)	.18
	Imaging utilized (all modalities)	41 (71%)	33 (85%)	.15
	IVU or CTU	14 (24%)	20 (51%)	.009*
	Cystoscopy	16 (28%)	18 (46%)	.08
	Urine cytology	26 (45%)	17 (44%)	1
	Adherence to guidelines	18 (31%)	17 (44%)	.28
Differences in evaluation by physician specialty		Nonurologist (n = 82)	Urologist (n = 18)	
	Imaging utilized (all modalities)	59 (72%)	17 (94%)	.06
	IVU or CTU	23 (28%)	13 (72%)	<.0001*
	Cystoscopy	17 (21%)	18 (100%)	<.0001*
	Urine cytology	30 (37%)	13 (72%)	.009*
	Adherence to guidelines	19 (23%)	17 (94%)	<.0001*

Notes: Type of hematuria unknown in 3 patients.
All *P*-values represent Fisher's exact test.
IVU or CTU = intravenous urography or computed tomography urography.
*These values represent statistically significant differences.

subsequent imaging was performed for recurrent or persistent hematuria (n = 15) or for follow-up of findings detected during initial work-up (tiny calyceal filling defect, renal cyst, and renal angiomyolipoma in one patient each); 3 patients showed previously undetected renal calculi. The remaining 5 patients initially had no imaging and underwent imaging during the follow-up period for recurrent or persistent hematuria; imaging in one showed renal calculi. Eight patients underwent cystoscopy during the follow-up period, all for recurrent or persistent hematuria; 5 of these had cystoscopy during the initial evaluation and 3 initially had no cystoscopy. No new cystoscopic findings were detected. None of the patients who underwent imaging or cystoscopy during the follow-up period was diagnosed with a urologic malignancy.

Sixteen patients died during the follow-up period (median survival of 34 months; range, 1-81 months). Two deaths were related to a urologic malignancy, both due to bladder cancer diagnosed with a guideline-adherent evaluation by urologist. Of the remaining 14 patients, 6 died of malignancy diagnosed before the study period, 4 died of non-urinary tract cancers diagnosed during the follow-up period (tongue, lung, gastric, and unknown primary), one died of cardiac disease, one of pulmonary capillary hemangiomatosis after a double lung transplant, one of acquired immunodeficiency syndrome, and in one patient the cause of death was unknown.

DISCUSSION

Although asymptomatic hematuria may signal serious disease, the diagnostic yield of the evaluation of patients with asymptomatic hematuria is low and the resultant cumulative cost high.[7-11] In absence of evidence-based data regarding the most cost-effective approach, clinical practice is currently guided by professional society guidelines that are based on literature review and expert opinion. To our knowledge, the degree to which guidelines are followed in clinical practice and the consequences of not adhering to them are unknown. The 2001 AUA guidelines were designed to provide clinical practitioners a specific set of recommendations that would optimize the evaluation of hematuria. However, a critical knowledge gap persisted, as noted by the 2012 AUA panel in their deliberations, namely "Distinguishing among patient subgroups for the purpose of differential work-up protocols is accompanied by high levels of uncertainty due to the absence of stratified information about the diagnostic yield associated with asymptomatic microscopic hematuria in patients who have been thoroughly worked up and carefully followed for long periods of time."[16] Despite this gap, the 2012 AUA guidelines were derived based on the authors' assumption that the "benefit of detecting and treating life-threatening urinary tract malignancy or other condition would benefit from intervention or management outweighs the risks/burden associated with a urologic evaluation."[16]

Our study attempts to narrow this knowledge gap and provide some stratified information about the diagnostic yield in patients with asymptomatic hematuria, some of whom were thoroughly evaluated and some who were not. Our data are particularly relevant to internists who comprised 62% of the initial care providers evaluating hematuria in our study. Overall, a minority of patients (36%) was evaluated according to the 2001 AUA guidelines. No urologic cancers were diagnosed in patients who did not undergo a guideline-adherent evaluation. However, the possibility of an occult urologic malignancy remains in these patients, particularly because not all of them underwent upper tract imaging and cystoscopy. Nevertheless, the median follow-up of 7.5 years, though variable, supports the notion that the index episode of hematuria in our study was unlikely to be due to a urinary tract malignancy. We also acknowledge that the guidelines were written to detect all causes of hematuria (and indeed other potential causes of hematuria were found in 33 patients), but we evaluated guideline adherence mainly from the perspective of diagnosing urologic cancers, as this is often the greatest clinical concern, particularly when the initial evaluation is negative.

In this study, only 5% (5/100) of patients with asymptomatic hematuria were diagnosed with a urologic malignancy, an incidence consistent with or slightly higher than prior studies.[3,16] Of 36 patients who were evaluated according to the guidelines, 14% (5/36) were diagnosed with a urologic malignancy. This finding supports the usefulness of the guidelines in detecting urologic malignancies in patients with asymptomatic hematuria. Of the 64 patients whose evaluation was not guideline-adherent, 24 did not undergo upper tract imaging and 63 did not undergo cystoscopy. Our results suggest that if some of these patients had undergone a guideline-adherent evaluation, additional upper tract imaging tests and cystoscopies would have been negative for cancers.

We found no difference in the frequency of guideline-adherent evaluation between high- and low-risk patients with hematuria. However, there was substantial variability in the way patients were evaluated; guideline adherence varied by type of hematuria and physician specialty. Patients with gross hematuria were more likely to undergo upper tract imaging. Patients evaluated by urologists were more likely to undergo upper tract imaging, cystoscopy, urine cytology, and have a guideline-adherent evaluation. In fact, almost all urologists adhered to the guidelines. Indeed, urologists would be expected to be more familiar and to agree with guidelines written by the AUA. Urologists also may be more likely than other physicians to order diagnostic tests because they may feel "obligated" to diagnose the cause of hematuria. This obligation could be due to a sense of wanting to respond to a referral and take action, or to the belief that hematuria is a "urologic" problem.

Evaluations by nonurologist physicians were more often nonadherent, lacking upper tract imaging, cystoscopy, or both. Some may not have been aware of the 2001 AUA guidelines. Others may not have agreed with them, perhaps because they were not based on high-quality evidence. Others may have had difficulty translating the recommendations into their practice due to inertia of previous practice habits, lack of outcome expectancy, or time limitations.[24] These reasons are speculative and could be addressed further with survey data. Patients with gross hematuria more often underwent CT urography, although the presence or absence of gross hematuria did not affect guideline adherence.

Although the definition of hematuria remains the same, the 2012 AUA guidelines differ from the 2001 guidelines in 5 principal ways.[15] First, other than age, the risk factors affect management of unexplained hematuria, but not the initial evaluation. Second, one positive urinalysis is sufficient to trigger an evaluation in all patients. Third, the age threshold that triggers an evaluation was reduced from 40 to 35 years. Fourth, CT urography is the upper tract imaging test of choice; in 2001, intravenous urography was an option. Finally, in the 2001 guideline, once an evaluation was initiated, cytology was recommended for inclusion. Cytology is now reserved for patients with one or more risk factors. Indeed, in our study, cytology did not add information that was not provided by imaging or cystoscopy. This finding is consistent with a recent report of 2778 patients who underwent urine cytology; only 2 had negative cystoscopy and imaging, positive cytology, and were diagnosed with a urothelial carcinoma.[25] Given our results, because a 2012 AUA guideline-adherent evaluation is triggered by one positive sediment and includes patients

younger than 40 years, we could postulate that if the 2012 guidelines had been followed in our patient cohort, the proportion of guideline-adherent evaluations would have been even lower. As a corollary, if all patients in our cohort had undergone a 2012 AUA guideline-adherent evaluation, perhaps a higher number of imaging tests and cystoscopies would have been negative for cancer.[15] Although we did not examine the downstream effect of the evaluation, it is also likely that some of these additional tests would have been falsely positive and yield incidental findings, all engendering testing, some of which would have been unnecessary.[26,27] Therefore, while acknowledging that cancer is not the sole purpose for evaluating hematuria, it is tempting to postulate that future guidelines could be devised such that fewer patients would need to be evaluated. The variability in the evaluation also indicates a need for increased awareness and acceptance of the hematuria guidelines among non-urologist physicians. This could be approached in several ways, including the formation of multispecialty efforts, multisource publication, and clinical decision support.[28]

A limitation of our study included its retrospective nature; however, this design allowed us to assess the primary outcome using a long follow-up period (median 89 months). Also, our study was performed in one institution; multicenter studies would allow broader assessment of guideline adherence. Because chart review did not allow us to evaluate for all risk factors, we may have overestimated the number of low-risk patients. However, because a single risk factor rendered a patient "high-risk," the number of patients in the high-risk category was not overestimated. Therefore, our conclusions remain unaffected. Finally, the sample size of 100 was relatively small, yet adequate; our study was powered to the 95% confidence level and 10% confidence interval. The duration of follow-up was variable in our cohort (median 89 months [interquartile range 33-97 months]). Finally, the purpose of this study was not to assess the effectiveness or appropriateness of the AUA guidelines themselves; we assessed the physician adherence to the AUA guidelines and its impact on the diagnosis of urologic cancer.

In summary, there was substantial variability in the way patients were evaluated by the type of hematuria and physician specialty. Most patients with asymptomatic hematuria were not evaluated according to published guidelines. Only 5% of patients were found to have urologic cancer, all of whom were evaluated according to the guidelines. No urologic cancers were diagnosed in patients in whom guidelines were not followed; however, because not all these patients were thoroughly tested, occult malignancies may have been present. This study indicates the need for further optimization of the approach to patients with asymptomatic hematuria with the ultimate goal of using health care resources more consistently and efficiently.

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