Radiological Imaging of Patients With Suspected Urinary Tract Stones:National Trends, Diagnoses, and Predictors

ACADEMIC EMERGENCY MEDICINE 2011; 18:700–707 A 2011 BY THE SOCIETY FOR ACADEMIC EMERGENCY MEDICINE

ANTONIO C. WESTPHALEN, MD, RENEE Y. HSIA, MD, MSC, JUDITH H. MASELLI, MSPH, RALPH WANG, MD, AND RALPH GONZALES, MD, MSPH

SUPERVISOR VS 吳柏衡
PRESENTATION R2 吳志華
1000808

Urinary tract stones

- affect approximately 5% of the U.S. population
- 1.0 to 2.5 per 1,000 persons per year in women and 1.4 to 3.8 per 1,000 persons per year in men.
- American College of Radiology has recommended computed tomography (CT) as the first line of investigation for suspected urinary tract stones in the adult population
- Ultrasound (US) is also considered an acceptable first line option in some European and South American countries

CT scan v.s US

- CT
  - Superior accuracy
  - Alternate diagnoses
- US
  - lack of radiation exposure
  - operator dependency
- more than half of renal calculi missed by US are smaller than 5 mm

Objectives

- Overutilization of computed tomography (CT) is a growing public health concern due to increasing health care costs and exposure to radiation
- Improving diagnoses and treatment plans?
- Trends of CT and ultrasound (US) utilization for assessment of suspected urolithiasis in emergency departments (EDs)
- Changes in diagnosis rates for urolithiasis or other significant disorders and hospitalization rates?

Methods

- retrospective cross-sectional analysis of ED visits from the National Hospital Ambulatory Medical Care Survey (NHAMCS) between 1996 and 2007.
- Visits for flank or kidney pain receiving CT or US testing
- calculated the diagnosis and hospitalization rates for urolithiasis and other significant disorders.

Methods

- 3-year intervals
- 50 states and the District of Columbia
- Geographic units
- Nonpregnant adult patients (age>18 years)
- Primary reason for visit of flank pain or kidney pain
- ICD-9 CM codes 592.x (calculus of kidney and ureter) or 594.x (calculus of lower urinary tract).

Main outcome

- Proportion of visits for flank or kidney pain receiving CT and / or US testing.
- Specific diagnosis rates and hospital admission rates as secondary outcomes

Alternative diagnoses

- Acute infectious / inflammatory processes (including pleural effusion)
- Acute cardiovascular events
- Malignant neoplasms.

RESULTS

- 3,818 actual sampled ED visits for flank or kidney pain by adults present in the NHAMCS, which represents an estimated 14.3 million visits (95% CI = 12.9 to 15.8) across the United States.

Table 3
Multivariate Logistic Regression Model of CT Utilization

	OR	95% CI
Patient characteristics		
Age, yr		
18–44 (ref)	—	—
45–64	1.43	0.93–2.21
>65	0.88	0.32–2.38
Sex		
Female (ref)		
Male	1.83	1.22–2.77
Race/ethnicity		
Non-Hispanic white (ref)	—	—
Non-Hispanic black	0.67	0.38–1.16
Hispanic	0.84	0.45–1.58
Other	0.48	0.23–0.98
Insurance		
Private (ref)	—	—
Medicare	0.73	0.33–1.63
Medicaid	0.67	0.39–1.14
Uninsured/self	1.16	0.68–1.99
Other	0.30	0.07–1.23
Presenting level of pain		
None	—	—
Mild	2.57	0.99–6.65
Moderate	1.43	0.54–3.81
Severe (ref)	2.96	1.14–7.65
Triage		
<15 minutes (ref)	2.41	1.08–5.37
15–60 minutes	2.01	1.01–4.01
1–2 hours	1.91	0.88–4.13
2–24 hours	—	—
Hospital characteristics		
Region		
Northeast (ref)		
Midwest	0.71	0.42–1.19
South	0.50	0.29–0.85
West	0.38	0.20–0.74
SMSA		
Rural	0.34	0.19–0.61
Urban (ref)	—	—
Safety-net hospital		
Yes	0.68	0.43–1.07
No (ref)	—	—
Teaching hospital		
Yes	0.64	0.31–1.31
No (ref)	—	—
Provider type		
Physician (ref)	—	—
Resident	1.38	0.60–3.20
Other	0.19	0.07–0.53

NHAMCS ED 2005–2007 adult, nonpregnant visits, with primary reason for visit of flank pain/kidney pain.
NHAMCS = National Ambulatory Medical Care Survey; SMSA = Standard Metropolitan Statistical Area.

Table 1
NHAMCS ED 1996–2007 Adult, Nonpregnant Visits, With Primary Reason for Visit of Flank Pain/Kidney Pain

	1996–1998	1999–2001	2002–2004	2005–2007	p-values
Number of visits	1,629	868	1,176	1,145	—
Estimated visits*	2,876,566 [2,418,161–3,334,971]	3,635,441 [2,964,892–4,305,990]	3,556,561 [3,110,189–4,002,933]	4,273,515 [3,490,287–5,056,743]	0.07
Imaging utilization†					
None	2,601,160 (90.4) [2,173,276–3,029,044]	2,780,014 (76.5) [2,238,107–3,321,921]	2,253,311 (63.4) [1,942,812–2,563,810]	2,298,538 (53.8) [1,840,508–2,756,568]	<0.001
US	153,236 (5.3) [94,291–212,181]	160,052 (4.4) [86,901–233,203]	163,426 (4.6) [106,929–219,923]	103,750 (2.4) [54,088–153,412]	0.01
CT	116,177 (4.0) [52,951–179,403]	665,344 (18.3) [474,001–856,687]	1,096,462 (30.8) [900,650–1,292,274]	1,814,727 (42.5) [1,411,353–2,218,101]	<0.001
Dx of urolithiasis	513,383 (17.8) [376,393–650,373]	657,236 (18.1) [472,228–842,244]	694,740 (19.5) [556,505–832,975]	812,213 (19.0) [598,736–1,025,690]	0.55
Admissions, any Dx	336,328 (11.7) [244,088–428,568]	409,503 (11.3) [274,259–544,747]	356,796 (10.0) [271,583–442,009]	451624 (10.6) [313,787–589,461]	0.49

Numbers in parentheses are percentages; numbers in brackets are 95% CIs.
*Trend test performed on visits with weighted linear regression.
†Trend test based on percentages.
Dx = diagnosis; NHAMCS = National Ambulatory Medical Care Survey; US = ultrasound.

Table 2
Proportion of Patients With a Primary Abdominal or Thoracic Diagnosis, Stratified by Diagnoses Group: NHAMCS ED 1996–2007
Adult, Nonpregnant Visits, With Primary Reason for Visit of Flank Pain/Kidney Pain

Diagnosis Group*	1996–1998	1999–2001	2002–2004	2005–2007	p-value†
1	17.9 (14.0–21.7)	18.1 (14.6–21.5)	19.5 (16.5–22.6)	19.0 (12.8–25.2)	0.55
2	6.8 (1.2–12.4)	9.3 (0.4–18.1)	6.7 (0.4–12.9)	6.7 (0–14.8)	0.46

Data are reported as % (95% CI). Group 1 = urolithiasis; Group 2 = acute infectious/inflammatory processes (including pleural effusion); Group 3 = acute cardiovascular event; Group 4 = malignant neoplasms.
*For any given period, groups of acute cardiovascular events and malignant neoplasms had fewer than 30 visits (<0.8%) and not considered reliable by the National Center for Health Statistics.
†Trend test based on percentages.

DISCUSSION

- Marked rise in the utilization of CT scan
- During the same period of time, the proportion of patients who did not receive imaging and the proportion receiving US each decreased by half.
- 1) the superior accuracy of the CT scan, 2) resource availability, and 3) increased clinician intolerance for diagnostic uncertainty.
- US are only available during certain hours.
- Defensive medicine

LIMITATIONS

- NHAMCS estimates
- Repeated visits (does not contain individual patient identifiers)
- Urolithiasis is overestimated in patients who do not undergo imaging.
- These include potentially lower accuracy of reason for visit, ICD-9 diagnoses, and procedure codes.

CONCLUSIONS

- Care Survey over the time period of 1996 to 2007,10-fold increase in the utilization of CT scan for patients with suspected kidney stone.
- did not find any appreciable change in the diagnosis of kidney stone, diagnosis of significant alternate diagnoses, or admission to the hospital over the same time period.

Electrocardiogram Findings in Emergency Department Patients with Syncope

ACADEMIC EMERGENCY MEDICINE • JULY 2011, VOL. 18, NO. 7 • WWW.AEMJ.ORG

JAMES QUINN, MD, MS, AND DANIEL MCDERMOTT, MD

Syncope

- transient loss of consciousness resulting in loss of postural tone, followed by spontaneous recovery with return to baseline neurologic function.
- 1.2% of emergency department (ED) visits and up to 6% of acute hospitalizations
- Neurocardiogenic (vagal) presentations being the most common.
- 5% to 10% of these patients suffering significant morbidity or mortality.(Cardiac arrhythmia and sudden death)

Syncope

- There is a large variation in the number of patients admitted, with the rate in the United States reported to be 50% to 85% (Canada and Australia the admission rate is between 15% and 30%)
- Admission decision? predictors or risk factor?
- "abnormal" ECG 每個study都不太一樣

San Francisco Syncope Rule

- • C - History of congestive heart failure
- • H - Hematocrit < 30%
- • E - Abnormal ECG
- • S - Shortness of breath
- • S - Triage systolic blood pressure < 90

San Francisco Syncope Rule

- The largest series of prospective consecutive ED patients with syncope examined emergency physician interpretation of ECGs
- Definition of an abnormal ECG included any nonsinus rhythm on the 12-lead ECG and/or new changes in the ECG compared to a previous ECG.
- Did not distinguish cardiac outcomes from noncardiac serious outcomes.
- Did not specify which ECG findings were abnormal.

Objectives

- To determine the sensitivity and specificity of the San Francisco Syncope Rule (SFSR) Electrocardiogram (ECG) criteria for determining cardiac outcomes and to define the specific ECG findings that are the most important in patients with syncope.

Methods

- A consecutive cohort of emergency department (ED) patients with syncope or near syncope was considered.
- For the ECG assessment, the physicians were asked to categorize the ECG as normal or abnormal based on any changes that were old or new.
- Separate rhythm assessment ECGs or available monitoring strips
- The final ECG criterion for the SFSR was any nonsinus rhythm or new ECG changes

Methods

- In this reanalysis
- To determine only cardiac-related outcomes (arrhythmia, myocardial infarction, structural, sudden death, acute cardiac intervention such as pacemaker insertion and cardiac catheterization) based on set criteria
- The sensitivity and specificity of the ECG criteria for cardiac outcomes only.

Methods

- All ECGs classified as abnormal by the study criteria were collected.
- Official cardiology reading

RESULTS

- Of the 684 patients, 634 had an ECG and rhythm analysis completed by an attending physician, and 10 had no ECG but a rhythm analysis documented.

RESULTS

Table 1
Clinical and Demographic Characteristics

	All (N = 684)	Abnormal ECG Criteria (n = 216)	Cardiac Outcomes (n = 42)
Mean age (yr)	62.1 (±23)	72.5 (±17)	78.6 (±9.5)
Female	402 (58.9)	201 (48.6)	17 (40.1)
Admitted	376 (54.9)	165 (76)	41 (98)
Mean admission length (days)	1.6 (±2.4)	2.2 (±3)	4.9 (±4.2)
7-day serious outcomes	79 (11.5)	49 (23)	
Cardiac outcomes	42 (6.1)	36 (17)	
Arrhythmia	30 (4.4)	28 (13)	
Ischemic	9 (1.3)	6 (2.8)	
Structural	3 (0.4)	1 (0.1)	

Values are given as n (%) or mean (±SD).

RESULTS

Table 2
Sensitivity and Specificity of SFSR ECG Criteria for Detecting Cardiac Outcomes

	Criteria Positive	Criteria Negative
Cardiac outcome	36	6
No cardiac outcome	180	422
Total	216	428

Sensitivity = 86% (95% CI = 71% to 94%); specificity = 70% (95% CI = 66% to 74%); negative predictive value = 99% (95% CI = 97% to 99%); LR positive = 2.9 (95% CI = 2.4 to 3.4); LR negative = 0.2 (95% CI = 0.1 to 0.4).
ECG = electrocardiogram; LR = likelihood ratio; SFSR = San Francisco Syncope Rule.

Criteria Negative

- Six patients
- Three were diagnosed with non-Q-wave MI, one of whom died during cardiac catheterization (All were felt to have ECGs that were unchanged from previous readings.)
- One had an exacerbation of CHF resulting in eventual death during hospitalization with an unchanged ECG on ED evaluation
- Two were felt to have completely normal ECGs but were subsequently diagnosed with SVT.

Table 3
Univariate Analysis of Specific ECG and Rhythm Findings

Finding	Cardiac Outcome (n = 36)	No Cardiac Outcome (n = 180)	p-value
ECG			
Isolated complete LBBB	5 (14)	7 (4)	0.03
Any LBBB	15 (42)	49 (27)	0.01
RBBB	4 (11)	16 (9)	0.68
Q-waves	7 (19)	36 (20)	0.94
Ventricular ectopy	4 (11)	16 (9)	0.67
Sinus on ECG only	23 (64)	133 (74)	0.19
ST segment changes	4 (11)	11 (6)	0.23
Rhythm			
Sinus	7 (19)	67 (37)	0.04
SVT	1 (3)	1 (0.1)	0.20
Bradyarrhythmia	9 (25)	45 (25)	1.0
PVC	2 (6)	5 (3)	0.58
Other	17 (47)	61 (34)	0.13
Any nonsinus	29 (81)	113 (63)	0.04

Values are reported as n (%)
ECG = electrocardiogram; LBBB = left branch bundle block; PVC = premature ventricular contraction; RBBB = right branch bundle block; SVT = supraventricular tachycardia.

Rhythm assessment

- On separate rhythm assessment (using all ED information including monitoring), a significantly greater number of patients were found to have nonsinus rhythms compared to the rhythm assessment using only the ECG reading (72% vs. 34%, p = 0.001)

Table 4
Multivariate Analysis of Important ECG and Rhythm Findings

	Adjusted OR	95% CI
Any LBBB	3.2	1.4–6.9
Any nonsinus rhythm	2.8	1.1–6.8

ECG = electrocardiogram; LBBB = left branch bundle block.

DISCUSSION

- Cardiac outcome in a patient with normal SFSR ECG criteria was very low.
- Nonsinus rhythms any time during an ED evaluation and left bundle branch conduction problems on ECG to be important specific ECG findings.
- Over half of abnormal rhythms will be missed if only one ECG during the ED visit is used as the only source for rhythm determination.

LIMITATIONS

- The number with a sinus rhythm decreased substantially when all sources were used to determine the rhythm
- Cannot make recommendations on who should be monitored or for how long
- Some old changes that may have been important.

CONCLUSIONS

- ECG and rhythm findings from all sources (multiple ECGs and rhythm strips) are important.
- Any left branch bundle block conduction problems or any nonsinus rhythms found during the ED evaluation of patients with syncope should be particularly concerning.