Provider Variation in the Quality of Metabolic Stone Management

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Purpose: Urinary stone disease is a chronic condition for which secondary prevention (dietary and medical therapy guided by 24-hour urine collection results) has an important role. Assessing the response to these interventions with followup testing is recommended and yet to our knowledge provider compliance with these guidelines is unknown.

Materials and Methods: Using Litholink® files from 1995 to 2013 we identified adults with urinary stone disease who underwent metabolic evaluation and the providers who ordered the evaluation. By focusing on patients with an abnormality on the initial collection we determined the proportion who underwent a followup test within 6 months of the initial test. Multilevel modeling was done to quantify variation in followup testing among providers after accounting for various patient and provider factors.

Results: A total of 208,125 patients had an abnormality on the initial collection, of whom only 33,413 (16.1%) performed a repeat collection within 6 months. While most variation in followup testing was attributable to the patient, the provider contribution was nontrivial (18.0%). The specialty of the ordering provider was important. Patients who saw a urologist had 24% lower odds of repeat testing compared to those who saw a primary care physician (OR 0.76, 95% CI 0.67−0.86, p <0.001).

Conclusions: Followup testing is uncommon in patients with an abnormal initial 24-hour urine collection. Given the observed provider variation, efforts to educate providers on the value of followup testing are likely to have salutary effects on patients with metabolic stone disease.

Key Words: urinary calculi, urinalysis, physician's practice patterns, standards, chronic disease

Accepted for publication September 29, 2014.

Study received University of Michigan Health Sciences institutional review board approval.

Supported in part by Agency for Healthcare Research & Quality Grant 1K08HS020927-01A1 (JMH).

* Financial interest and/or other relationship with Litholink, Laboratory Corporation of America® Holdings.

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Urinary stone disease is a highly prevalent condition associated with substantial pain and suffering in affected patients.[1] Moreover, the disease is not a one-time event since 50% of patients experience a second episode of renal colic within 5 years of the first episode and at least 10% experience 3 or more recurrences in a lifetime.[2–4] As such, urinary stone disease is most appropriately viewed as a chronic condition for which secondary prevention is important. For stone formers this entails dietary interventions and selective medical therapy guided by the results of 24-hour urine collection to optimize modifiable risk factors.[5]

0022-5347/15/1933-0885/0
THE JOURNAL OF UROLOGY®

http://dx.doi.org/10.1016/j.juro.2014.09.111
Vol. 193, 885-890, March 2015
Printed in U.S.A.

However, while contemporary practice guidelines recommend metabolic stone management in patients at highest risk for recurrence,[6–8] little is known about the quality of this care after it is initiated. Prior studies of other chronic conditions show substantial variation among providers with respect to their secondary prevention efforts.[9] For instance, there is significant variability among physicians in therapeutic monitoring of patients with diabetes.[10] Moreover, an empirical study revealed provider specific differences in chronic disease management, suggesting that physician type is also a determinant of care quality.[11]

In this context we used data from one of the largest central laboratories in the United States to examine patients with metabolic stone disease. After identifying patients with abnormal 24-hour urine chemistry we calculated the proportion who underwent a second urine collection using this as a measure of quality of care. We then quantified the degree of variation in repeat 24-hour urine testing attributable to providers and assessed differences in repeat testing rates between specialist and primary care physicians.

METHODS

Data Source and Study Population

We used Litholink analytical files containing demographic data and 24-hour urine collection results on community dwelling patients with urinary stone disease from 1995 to 2013. Specifically we identified adults older than 18 years with abnormal urine chemistry on a properly collected specimen. We used gender specific reference ranges to define hypercalciuria, hyperoxaluria, hypocitraturia and hyperuricuria (table 1). While low urine volume is a risk factor for recurrent stone disease, isolated volume abnormalities were not included in analysis since patients are often counseled to increase fluid intake alone. Thus, repeat urine collections may not be necessary.

To assess collection adequacy we compared the ratio of creatinine concentration to patient weight in kg using the reference ranges of 15 to 20 mg/kg per day in women and 18 to 24 mg/kg per day in men.

Metabolic Stone Management Quality

Dietary interventions and selective medical therapy can correct abnormal urine chemistry, decreasing the risk of stone recurrence in a patient. Repeat 24-hour urine collection is recommended under current practice guidelines, including the recently released AUA (American Urological Association) guidelines on medical management of nephrolithiasis, which state, "Clinicians should obtain a single 24-hour urine specimen for stone risk factors within six months of the initiation of treatment to assess response to dietary and/or medical therapy."[6] Thus, to assess quality we determined the proportion of patients in our cohort who underwent followup testing. We did this by constructing a time window around the initial abnormal collection of each patient, extending from 4 weeks to 6 months after collection. We then distinguished between patients who did and did not collect another 24-hour urine sample during this window.

Table 1. *Urinary parameter reference ranges*

	Daily Range	
	Reference	Extended
Hypercalciuria (mg):		
Male	Greater than 250	Greater than 300
Female	Greater than 200	Greater than 250
Hyperoxaluria (mg)	Greater than 40	
Hypercitruria (mg):		Less than 320
Male	Less than 450	
Female	Less than 550	
Hyperuricuria (gm):		
Male	Greater than 0.800	
Female	Greater than 0.750	

Patient and Physician Characterization

We characterized patients for a range of sociodemographic factors, including age at the initial abnormal collection, gender, urban/rural residence and United States Census region (Midwest, Northeast, South or West). We measured patient socioeconomic status using the composite measure described by Diez Roux et al.[12] Given the possibility of specialty specific differences, we also determined the physician type of the treating provider (endocrinology, nephrology, primary care or urology) using codes provided by Litholink.

Statistical Analysis

For our initial analytical step we determined the overall proportion of patients in our cohort who underwent followup testing and assessed for temporal trends in this proportion. We then compared patients who did and did not collect a repeat 24-hour urine after the initial abnormal collection. We made these bivariate comparisons for the patient and provider factors described using the chi-square test.

To quantify the degree of variation in followup testing we used multilevel modeling, which was helpful for 2 reasons. 1) It accounted for the interdependence of observations (ie clustering of patients by physicians), that is outcomes in patients treated by the same provider tend to correlate more highly than outcomes in patients selected at random from the general population. 2) It enabled us to partition the variation in followup testing between the patient and the provider. By partitioning the variation into these 2 levels we could quantify the proportion of the total variation in followup testing attributable to provider specific characteristics and the philosophy of care.

For our binary outcome measure we fit a series of multilevel models. Specifically we used generalized linear mixed models, assuming a binomial error distribution with a logit link function. Our first model, which included no explanatory variables (null model), decomposed the total variation in followup testing into its patient and provider components. We then added patient factors (age, gender, urban/rural status, socioeconomic status and region of