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Emergency department visits, use of imaging, and drugs for urolithiasis have increased in the United States

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The occurrence of urolithiasis in the United States has increased; however, information on long-term trends, including recurrence rates, is lacking. Here we describe national trends in rates of emergency department visits, use of imaging, and drug treatment, primarily using the National Hospital Ambulatory Medical Care Survey to describe trends and the National Health and Nutrition Examination Survey to determine the frequency of lifetime passage of kidney stones. Emergency department visit rates for urolithiasis increased from 178 to 340 visits per 100,000 individuals from 1992 to 2009. Increases in visit rates were greater in women, Caucasians, and in those aged 25–44 years. The use of computed tomography in urolithiasis patients more than tripled, from 21 to 71%. Medical expulsive therapy was used in 14% of the patients with a urolithiasis diagnosis in 2007–2009. Among National Health and Nutrition Examination Survey participants who reported a history of kidney stones, 22.4% had passed three or more stones. Hence, emergency department urolithiasis visit rates have increased significantly, as has the use of computed tomography in the United States. Further research is necessary to determine whether recurrent stone formers receive unnecessary radiation exposure during diagnostic evaluation in the emergency department and allow development of corresponding evidence-based guidelines.

Kidney International (2013) **83,** 479–486; doi:10.1038/ki.2012.419; published online 2 January 2013

KEYWORDS: computed tomography; NHAMCS; radiation

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Received 18 March 2012; revised 27 September 2012; accepted 11 October 2012; published online 2 January 2013

Urolithiasis is one of the most common urological diseases in the United States.[1] The lifetime risk of symptomatic kidney stones is ~13% in men and 7% in women.[2,3] The prevalence is highest in older white men and lowest in younger black women.[2–4] Studies suggest that kidney stone presentation also varies by season and geographic region, with greater frequency observed during the warmer months and in the southern United States.[4–7] Only limited information is available on urolithiasis recurrence rates. The financial burden of urolithiasis is substantial.[8] Total annual medical expenditures for urolithiasis in the United States exceeded $2 billion in 2000, and are expected to increase in the future.[7] An important factor in the increased cost is the use of medical imaging technology for the evaluation of urolithiasis patients. However, there is also concern regarding the extent of use of radiation in the evaluation of patients because of potential adverse long-term sequelae, especially in patients with recurrent disease and in younger patients.[9]

Although individuals with kidney stones may be asymptomatic, many may experience severe pain from stone passage.[10] The prevalence and incidence of urolithiasis is increasing globally[11–14] and in the United States.[2,15–17] However, reports of long-term trends in the occurrence of urolithiasis in the United States are lacking. We examined trends in diagnosis, use of imaging and drugs, and regional and seasonal variation for urolithiasis in a nationally representative sample of US emergency department (ED) visits (National Hospital Ambulatory Medical Care Survey, NHAMCS) over nearly a two-decade period beginning in the early 1990s. We determined urolithiasis ED return visits using the NHAMCS database and evaluated the number of episodes of self-reported kidney stones among a nationally representative sample of the population (National Health and Nutrition Examination Survey, NHANES) to identify a subgroup of patients who may receive unnecessary radiation exposure from imaging during evaluation in the ED for suspected urolithiasis.

The goals of this study were to assess secular trends in ED urolithiasis visits, including imaging use in the United States, and to estimate urolithiasis recurrence rates and return visits in national and ED populations.

RESULTS

Emergency department visit rates

A total of 551,577 ED visits were sampled from 1992 to 2009. Upper tract urolithiasis was coded in 3403 visits. Accounting for the sampling weights and complex sample design, over this time, there were an estimated 12.45 million ED visits (95% confidence interval (CI), 11.22–13.67 million) with a diagnosis of upper tract urolithiasis, or about 700,000 visits per year in the United States. These visits accounted for about 0.65% (95% CI, 0.61–0.69%) of all ED visits. To examine temporal trends in urolithiasis, the number of ED visits with a diagnosis code for urolithiasis was calculated as the average annual ED visit rate. Among the entire U.S. noninstitutional population, the rate of ED visits with a diagnostic code for urolithiasis steadily increased from 178 (95% CI, 152–204) per 100,000 individuals in the 1992–1994 survey period to 340 (95% CI, 284–395) per 100,000 individuals in the 2007–2009 survey period (Figure 1), an increase of 91% ($P_{trend} < 0.001$). On the basis of a linear regression model by fitting the first five visit rates from the 1992–1994 survey period to the 2004–2006 survey period, we obtained a projected increase of 27 ED visits per 100,000 individuals by each 3-year period (rate = 147 + 27* period). Compared with the predicted rate of 309 (95% CI, 280–337) for the 2007–2009 survey period, the observed rate of 340 (95% CI, 284–395) corresponded to an excess increase of 31 ED visits per 100,000 US population. However, the rate increase in the last period was not significantly greater than the trend seen in the previous surveys ($P = 0.15$).

Across all survey periods, ED visit rates for urolithiasis were higher in men than women (Table 1). Although urolithiasis ED visit rates increased in both genders from the survey periods 1992–1994 to 2007–2009, the percentage of increase in women (128%) was nearly twice that of men (70%). In 1992–1994, the highest rate of ED visits for urolithiasis was in individuals aged 45–64 years old. In all subsequent surveys, the highest rate was in individuals aged 25–44 years old. The increase in ED urolithiasis visit rates in each age group over the various surveys was statistically significant, except for individuals >64 years of age. The greatest increase (132%) was found in the 25–44 year age group. The ED visit rate for urolithiasis among whites was about twice that of non-whites for all survey periods except 2001–2003, where the white to non-white rate ratio was nearly 3:1.

Although ED visit rates varied by season and by region of the country, none of these differences were statistically significant (Figure 2).

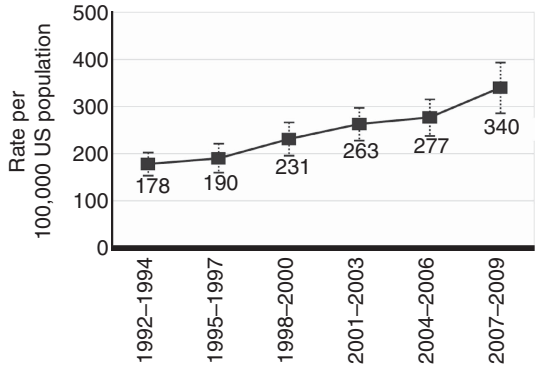

Figure 1 | Rates of visits per 100,000 US population with a diagnosis of upper tract urolithiasis to US emergency departments: 1992–2009. A weighted least-square regression analysis showed a significant linear trend. Error bars are 95% confidence intervals.

Use of imaging and drugs

The proportion of ED urolithiasis visits with any imaging used increased from 56% (95% CI, 48–64%) in 1995–1997 to 79% (75–83%) in 2007–2009 ($P_{trend} = 0.015$) (Table 2). The percent of ED urolithiasis visits at which X-rays were ordered decreased from 48% (95% CI, 40–55%) in 1995–1997 to 17% (12–22%) in 2007–2009 ($P_{trend} = 0.005$). In contrast, the use of computed tomography (CT) increased from 21% (95% CI, 15–26%) in 1998–2000 to 71% of visits (65–77%) in 2007–2009 ($P_{trend} = 0.029$). The frequency of the use of ultrasound was low: 5–6% in the survey periods 2001–2003 and 2004–2006.

Among urolithiasis ED visits with any imaging, the proportion of CT or X-ray/ultrasound use in the survey periods 1998–2003 and 2004–2009 is shown in Figure 3. In 1998–2003, approximately half the visits used CT, increasing to 88% in 2004–2009. The use of CT increased from 19% (95% CI, 11–27%) in 1998–2000 to 73% (65–80%) in 2007–2009 in patients aged 25–44 years old ($P_{trend} = 0.018$) and from 42% (28–56%) in 2001–2003 to 64% (51–77%) in patients <25 years in 2007–2009 ($P_{trend} < 0.001$) (Table 3). The use of CT did not differ proportionally between men and women with urolithiasis visits during any of the time periods assessed, but increased in men ($P_{trend} = 0.028$). The use of CT did not differ proportionally between white and non-white patients with urolithiasis visits during any of the time periods assessed, but the proportion of use increased significantly in white patients ($P_{trend} = 0.036$).

The proportion of ED visits for codes indicating other disorders of the urethra and urinary tract, symptoms involving the urinary system, and other symptoms involving the abdomen and pelvis with any imaging used increased from 38% (95% CI, 35–40%) in 1995–1997 to 55% (53–57%) in 2007–2009 ($P_{trend} < 0.001$). CT use in this group increased from 2% (95% CI, 2–3%) in 1995–1997 to 30% (28–32%) in 2007–2009 ($P_{trend} < 0.001$) (data not shown).

Prescribed drugs were commonly used over the survey periods (range 88–95%). Analgesic prescriptions increased from 77% (95% CI, 73–81%) to 91% (89–94%) ($P_{trend} = 0.022$) of visits. Medical expulsive therapy (MET) use was infrequent before 2007. In 2007–2009, MET was prescribed in 14% (95% CI, 10–17%) of ED urolithiasis visits. The mean number of prescribed drugs per ED urolithiasis visit increased from 2.1 (95% CI, 1.9–2.2) in 1992–1994 to 3.4 (3.1–3.6) in 2007–2009 ($P_{trend} = 0.008$).