Temporal trends in the incidence of kidney stone disease

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Recent reports show an increased occurrence of kidney stone disease worldwide. To further evaluate and quantify this observation, we examined recent trends in the incidence of kidney stone disease in the adult population of Iceland over a 24-year period. Computerized databases of all major hospitals and medical imaging centers in Iceland were searched for International Classification of Diseases, radiologic and surgical procedure codes indicative of kidney stones in patients aged 18 years and older. The time trends in stone frequency of 5945 incident patients (63% men) were assessed by Poisson regression analysis. The majority of patients (90.5%) had symptomatic stone disease. The total incidence of kidney stones rose significantly from 108 per 100,000 in the first 5-year interval of the study to 138 per 100,000 in the last interval. The annual incidence of symptomatic stones did not increase significantly in either men or women. There was, however, a significant increase in the annual incidence of asymptomatic stones over time, from 7 to 24 per 100,000 for men and from 7 to 21 per 100,000 for women. The increase in the incidence of asymptomatic stones was only significant for women above 50 years of age and for men older than 40 years. Thus, we found a significant increase in the incidence of kidney stone disease resulting from increased detection of asymptomatic stones. This was largely due to a more frequent use of high-resolution imaging studies in older patients.

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Kidney stone disease is a common health disorder in the Western world with a reported lifetime prevalence of 10–12% in men and 5–6% in women.[1–3] This disorder causes significant morbidity among affected patients and substantial financial burden to the society because of lost work days and health-care costs. The prevalence of calcium stones, the most common type of kidney stones, varies considerably between different ethnic groups and geographical areas, with the highest reported prevalence in Caucasian males.[1,4] Epidemiologic studies have suggested an association between calcium kidney stones and dietary calcium, protein, or salt intake[5–8] and warm climates.[9,10] Furthermore, a strong evidence for genetic predisposition to the pathogenesis of nephrolithiasis has also been demonstrated.[11–13]

Numerous reports have suggested upward trends in the incidence and prevalence of kidney stone disease in recent decades.[1,14–17] In contrast, a previous Icelandic study[18] did not find a significant increase in stone prevalence over the years 1967–1991. Similar to many prior studies, it was associated with methodological limitations, as it was based on self-reported history of kidney stones and was therefore subject to a recall bias. A recent population-based study from Olmsted County, Minnesota,[19] using International Classification of Diseases (ICD) codes for identification of symptomatic kidney stone cases, demonstrated relatively stable incidence rates from 1970 to 2000. At the end of the study period, there even appeared to be a downward trend in the overall incidence of kidney stones. Thus, studies examining trends in kidney stone disease have yielded variable results, some of which may be explained by differences in design.

Reliable information about the epidemiology of nephrolithiasis is important, as it may have clinical and economic implications. To determine as accurately as possible the recent trends in the incidence of kidney stone disease, we conducted a nationwide study in Iceland that was designed to identify virtually all known cases of kidney stones in the adult population during the past three decades.

RESULTS

Our search strategy identified a total of 8994 patients aged 18 years and above, by ICD codes ($n=4155$), radiology codes ($n=7116$), or surgical procedure codes ($n=879$) indicative of kidney stone disease. The same individuals were frequently identified by more than one coding system. After a thorough review of medical records, we excluded from the analysis 2040 patients who did not have kidney stones (the majority had other abdominal calculi or calcifications, most commonly gallstones) or who were residents of other countries. An additional 289 patients who had their first documented kidney stone in 1983 or 1984 were excluded because of incomplete coding during those years. Finally, 720 patients who carried a prior diagnosis of kidney stone disease were excluded from the incidence calculations.

Table 1 | Clinical manifestations of the 5945 incident kidney stone patients

Symptomatic patients	4826 (81.2%)
Flank pain	3572 (60.4%)
Abdominal pain	294 (6.3%)
Hematuria	484 (34.1%)
Urinary tract infection	217 (7.0%)
Other	259 (26.9%)
Asymptomatic patients	565 (9.5%)
Symptoms indeterminate	350 (5.9%)
Data not available	204 (3.4%)

Some patients had more than one clinical manifestation associated with kidney stones.

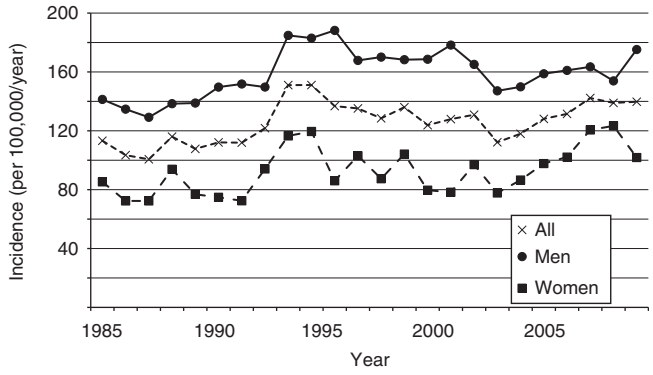

Figure 1 | Annual incidence of kidney stones in all patients and by gender in Iceland, 1985 to 2008.

From 1985 to 2008, the number of incident patients with kidney stones was 5945, of whom 3746 (63%) were men. The patients were almost exclusively non-Hispanic Caucasians, reflecting the ethnic composition of the Icelandic population. The mean age ($\pm$ s.d.) at diagnosis of kidney stones was 52.5 ± 17.4 years for men and 48.9 ± 19.1 years for women ($P<0.001$). The clinical manifestations of the 5945 patients are presented in Table 1. The majority of patients (81.2%) were symptomatic when they were first diagnosed with kidney stones, whereas 9.5% were asymptomatic. In 5.9% of patients, it was not possible to determine whether stone-related symptoms were present or not and records of the stone event were not available for an additional 3.5%. The annual incidence of kidney stone disease increased significantly during the study period, both for the total study population and for each gender (Figure 1). The incidence rose from 108 per 100,000 in the first 5-year interval of the study period to 138 per 100,000 in the last interval ($P<0.001$). In men, the incidence increased from 136 per 100,000 in the first interval to 163 per 100,000 in the last interval ($P=0.031$), and in women from 80 to 112 per 100,000 in the same respective time intervals ($P<0.001$). Figure 2 shows the trends in the incidence rates of symptomatic and asymptomatic stones. For symptomatic stones, the annual incidence rose from 130 to 140 per 100,000 in men ($P=0.66$) and from 73 to 91 per 100,000 in women ($P=0.13$), and thus did not reach statistical significance. The annual incidence of asymptomatic stones increased significantly for both genders, from 7 to 24 per 100,000 in men ($P<0.001$) and from 7 to 21 per 100,000 in women ($P<0.001$). These time trends were similar when kidney stone cases with indeterminate clinical symptoms or unavailable clinical data were counted with

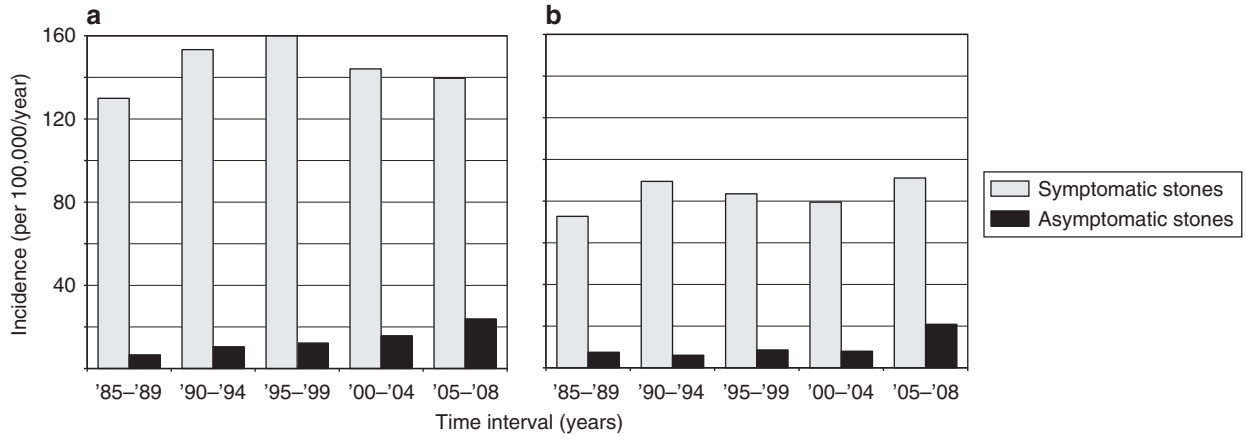

Figure 2 | Annual incidence of symptomatic and asymptomatic kidney stones in Iceland from 1985 to 2008, averaged for five time intervals. (**a**) Men and (**b**) women.