STONE DISEASE

Obesity, weight gain, and the risk of kidney stones

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Context: Larger body size may result in increased urinary excretion of calcium, oxalate, and uric acid, thereby increasing the risk for calcium-containing kidney stones. It is unclear if obesity increases the risk of stone formation, and it is not known if weight gain influences risk.

Objective: To determine if weight, weight gain, body mass index (BMI), and waist circumference are associated with kidney stone formation.

Design, Setting, and Participants: A prospective study of 3 large cohorts: the Health Professionals Follow-up Study (N = 45,988 men; age range at baseline, 40-75 years), the Nurses' Health Study I (N = 93,758 older women; age range at baseline, 34-59 years), and the Nurses' Health Study II (N = 101,877 younger women; age range at baseline, 27-44 years).

Main Outcome Measures: Incidence of symptomatic kidney stones.

Results: We documented 4827 incident kidney stones over a combined 46 years of follow-up. After adjusting for age, dietary factors, fluid intake, and thiazide use, the relative risk (RR) for stone formation in men weighing more than 220 lb (100.0 kg) vs men less than 150 lb (68.2 kg) was 1.44 (95% confidence interval [CI], 1.11-1.86; P = .002 for trend). In older and younger women, RRs for these weight categories were 1.89 (95% CI, 1.52-2.36; P<.001 for trend) and 1.92 (95% CI, 1.59-2.31; P<.001 for trend), respectively. The RR in men who gained more than 35 lb (15.9 kg) since age 21 years vs men whose weight did not change was 1.39 (95% CI, 1.14-1.70; P = .001 for trend). Corresponding RRs for the same categories of weight gain since age 18 years in older and younger women were 1.70 (95% CI, 1.40-2.05; P<.001 for trend) and 1.82 (95% CI, 1.50-2.21; P<.001 for trend). Body mass index was associated with the risk of kidney stone formation: the RR for men with a BMI of 30 or greater vs those with a BMI of 21 to 22.9 was 1.33 (95% CI, 1.08-1.63; P<.001 for trend). Corresponding RRs for the same categories of BMI in older and younger women were 1.90 (95% CI, 1.61-2.25; P<.001 for trend) and 2.09 (95% CI, 1.77-2.48; P<.001 for trend). Waist circumference was also positively associated with risk in men (P = .002 for trend) and in older and younger women (P<.001 for trend for both).

Conclusions: Obesity and weight gain increase the risk of kidney stone formation. The magnitude of the increased risk may be greater in women than in men.

Editorial Comment

Many urologists have long suspected that obese individuals are at increased risk of kidney stone formation, with the risk of stone disease assumed to be due to across-the-board overindulgence in substances know to be associated with stone formation, such as dairy products, animal protein and salt. Taylor and colleagues confirmed the suspicion of increased stone risk with obesity in 3 prospective cohort studies that used food frequency questionnaires and assessed the rate of incident stone formation. They determined that the relative risk (RR) of incident stone formation correlated positively with weight, weight gain and body mass index (BMI) in over 240,000 individuals comprising 3 large independent cohorts of men (Health Professional follow-up Study), younger women (Nurses' Health Study II) and older women (Nurses' Health Study I). Furthermore, this correlation held when adjusting for age and dietary and medication factors known to be associated with stone risk.

The mechanism by which obesity increases stone risk is not known. Several studies have linked obesity and insulin resistance with an increased risk of uric acid stone formation as a result of a defect in renal ammoniagenesis (1). Of note, this association was found to be independent of diet. Hyperinsulinemia has also been shown to have a hypercalciuric effect that could potentially increase the risk of calcium stones (2). Other investigators found higher urinary uric acid levels in obese stone formers compared with non-obese stone formers (3). Taken together, these studies suggest both diet-dependent and diet-independent mechanisms for the increased rate of stone formation. Given the increased difficulty in surgically treating stones in obese patients, efforts should be made not only to correct underlying metabolic risk factors in these patients, but also to encourage weight control.

References

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Treatment of complete staghorn stones: a prospective randomized comparison of open surgery versus percutaneous nephrolithotomy

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Purpose: We studied the role of open surgery versus percutaneous nephrolithotomy (PCNL) in the treatment of complete staghorn stones in a prospective randomized manner.

Materials and Methods: A total of 79 patients with 88 complete staghorn stones, defined as filling the entire collecting system or at least 80% of it, were prospectively randomized for PCNL (43) or open surgery (45). Intraoperative and postoperative morbidity, operative time, hospital stay, and stone clearance at discharge home and followup were compared for both methods. Patients with significant residuals in both groups were subjected to extracorporeal shock wave lithotripsy (Dornier Medical Systems, Inc., Marietta, Georgia) on an outpatient basis. Followup was completed for all cases with a mean duration +/- SD of 4.9 +/- 2.5 months (range 3 to 14). Renal function was evaluated by Tc-mercaptoacetyltriglycine renogram before and after treatment in both groups.

Results: Intraoperative complications in terms of bleeding requiring blood transfusion, and pleural, vascular or ureteral injuries were recorded in 7 patients (16.3%) in the PCNL and 17 (37.8%) in the open surgery groups, a difference of significant value ($p < 0.05$). Major postoperative complications including massive hematuria requiring blood transfusion, septicemia, urinary leakage and wound infection were observed in 8 patients (18.6%) in the PCNL group and in 14 (31.1%) in the open surgery group, a difference of no significant value. PCNL was associated with shorter operative time (127 +/- 30 vs 204 +/- 31 minutes, $p < 0.001$), shorter

hospital stay (6.4 +/- 4.2 vs 10 +/- 4.2 days, p <0.001) and earlier return to work (2.5 +/- 0.8 vs 4.1 +/- 1 weeks, p <0.001). On the other hand both treatment groups were comparable in regard to stone-free rates at discharge home (49% vs 66%) and at followup (74% vs 82%). At followup renal function improved or remained stable in 91% and 86.7% in the PCNL and open surgery groups, respectively.

Conclusions: PCNL is a valuable treatment option for complete staghorn stones with a stone-free rate approaching that of open surgery. Moreover, it has the advantages of lower morbidity, shorter operative time, shorter hospital stay and earlier return to work.

Editorial Comment

In 1997, the AUA Nephrolithiasis Clinical Guidelines Panel performed an extensive literature review to determine the optimal treatment of staghorn calculi (1). At that time, not a single prospective, randomized, trial compared any of the treatment options: SWL, PCNL, combination therapy and open surgery. Based on their review, they recommended PCNL, with or without adjuvant SWL, as preferred treatment for staghorn calculi, because it combined high stone free rates with relatively low morbidity. A new Guidelines Panel recently completed an update of the review process, and changed their recommendation for treatment of most staghorn calculi to PCNL-based therapy because of poorer stone free rates in recent series of combination PCNL/SWL, likely due to heavy reliance on SWL and less on flexible nephroscopy for stone clearance (unpublished). In their review, a single prospective, randomized trial compared SWL with PCNL monotherapy and showed clear superiority of PCNL (2). Open surgery series in the updated review were few, and a decline in success rates is thought to be due to reservation of open surgery for patients with only the most complex staghorn calculi and those requiring extensive reconstruction of the collecting system, as well as to less experience in this technique in the era of minimally invasive surgery.

The current authors performed a prospective, randomized trial comparing PCNL with open surgery for the treatment of complete staghorn calculi. They found that PCNL provided comparable stone free rates to open surgery but with reduced morbidity, shorter hospital length of stay and quicker recovery. These results validate the findings of the Guidelines Panel, and lend further credibility to the recommendation of PCNL-based therapy over open surgery by way of a non-biased comparison of the 2 modalities by a group of investigators with extensive experience in both approaches. Although open surgery has nearly vanished from practice in the U.S., the procedure is still performed in some countries with limited resources and equipment for newer minimally invasive techniques. With this trial, open surgery is relegated to an even more remote position in the armamentarium of surgical treatments for nephrolithiasis.

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