Review

Influence of Body Mass Index on Urinary Stone Disease

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Abstract

Background

The prevalence and incidence of urolithiasis have increased over the past 30 years. Some studies have concluded that increased BMI, associated with excess body weight or obesity is responsible for the higher rate of urolithiasis.

The aims of this study were to investigate the relationship of BMI, height and weight with urinary stone disease.

Materials and Methods

A total of 151 patients including 95 males and 56 females were enrolled in this study. The mean age was 42yrs. The duration of the study was 28 months from August 2007 to January 2010. BMI was stratified into 3 groups – 1) below normal range (BMI <18.5), 2) normal BMI range (from 18.5 to 22.9) and 3) above normal range (BMI 23 or >23 according to WHO BMI classification of Asia Pacific) and we compared the incidence rate of urolithiasis in each of the stratified groups. Body weight was stratified into 2 groups, less than and greater than the mean study weight of 56 kg. Fifty-six kilograms of body weight was taken as a cut-off value because 56 kg was the mean weight (standard deviation 11.71) of the study patient cohorts. Body weight was stratified into 2 groups less than and greater than the mean study height of 158 cm. Hundred fifty eight cm of body height was taken as a cut-off value because 158 cm was the mean height (Standard Deviation 8.28) of the study patient cohorts.

Results

A significant number of male patients(63%) were affected with urinary calculi compare with female patients(37%)( Confidence Interval-16). A significant number of overweight patients(50%) suffered from renal calculus when compared with the number of normal weight patients (30%) (confidence interval- 17.48). Higher weight (>56kg) male patients(48%) had significantly more compared with female patients(12%) a significant number of male patients affected with renal calculus(confidence interval-19.73). When male and female patients (17%,42% respectively) of height <158 cm compared with each other, a significant number of female patients affected with renal calculus(confidence interval-20.52). When male patients of height >158 cm compared with male patients of height <158 cm, there was significant difference showing male patients of height >158cm affected more with renal calculus(confidence interval-18.62). When female patients of height <158 cm compared with female patients of height >158 cm, there was significant difference showing more affected with renal calculus, having height <158cm(confidence interval-21.17). When male and female patients of height >158cm compared with each other, male patients were affected more with renal calculus(confidence interval-19.34). Pearson's correlation was calculated with height and BMI, height and weight. Weight and BMI are strongly correlated(R^2=0.69), which means that high weight variable scores go with high BMI variable scores and vice versa. Height and weight shows weak positive correlation(R^2=0.22) and height and BMI shows weak negative correlation(R^2=0.004). R= Pearson Correlation Coefficient.

Conclusions

Overweight has an influence renal stone formation. Persons having more BMI has an influence on urinary stone disease, specially male has more prevalence. Less height female has more prevalence renal stone than male. BMI, weight, and height of patients have a positive correlation specially weight and BMI are strongly correlated.

Key Words: BMI; Body Weight; Epidemiological Study

Introduction

Urinary stones disease has affected humans since the earliest records of civilization [1]. The etiology of stones remains speculative. Several epidemiological studies have shown a positive association between the incident stone risk and body mass index (BMI) and multiple risk factors has been proposed to explain this association. In the current study, we performed an analysis of BMI and body weight to a population of garments workers. Other metabolic, dietary profiles were not been explored [2, 3, 4].

Previously published studies have shown a relationship between body weight and obesity with urolithiasis [5]. Many metabolic diseases such as gastrointestinal (G.I) problems, chronic diarrhea, hereditary factor, geographic location have been shown to have their relationship with renal stone disease [6,7]. Some metabolic diseases, such as chronic diarrhea, decrease body weight, and hereditary small anthropomorphic-frame individuals all have effects on risk of renal calculus. It is unclear whether underweight persons have a chance in a rate of renal calculi, although researchers have shown the excess body weight increases predisposition of renal stones [3]. We attempted to determine the relationship of BMI (below the normal range, normal range and above normal range) with an incidence of urinary stone disease, without considering GI, metabolic, hereditary and other factors.

Materials and Methods

A total of 151 patients with urolithiasis that attended the Urology OPD, over the period from August 2007 to January 2010 were included in this study. The study place was situated in a rural community of Bangladesh, situated 35 Km away from the capital city. Gender distribution was 95 male and 56 female, male to female ratio was 1: 0.59. Mean age of male and female in years was 42 (Table 1). The data included patient’s age, sex, height, weight, and BMI. BMI was calculated as weight in kilograms divided by the square of the height in meters. BMI cut-off was adopted as suggested by WHO Asia Pacific Criteria, including underweight (below 18.5 kg/m2 BMI), normal weight (18.5 – 22.9 kg/m2 BMI), and overweight (23 or more kg/m2 BMI) (Table 2). The average weight of our patients was about 56kg, so body weight was stratified into two groups, 56kg or more and below 56kg. The average height of our patients was about 158 cm, so, height was stratified into 2 groups, below 158 cm and 158 cm or above (Table 3).
Results

Over weight was present in 50% (n=76) (>22.9 kg/m²), normal BMI (within the healthy range) was in 30% (n=45) (>18.5 and <22.9 kg/m²) patients and underweight was in 20% (n=30) (<18.5 BMI) of both sexes. In this study, a significant number of male patients (63%) affected with urinary calculi in compare with female patients (37%) (Confidence Interval-16). When compared with the number of normal weight patients (30%) a significant number of overweight patients (50%) suffered from renal calculus. When male patients (48%) of body weight 56kg or more compared with female patients (12%) a significant number of male patients affected with renal calculi. When male and female patients (17%, 42% respectively) of height <158 cm compared, a significant number of female patients affected with renal calculus. When male patients of height >158 cm compared with male patients of height <158 cm, there was significant difference showing male patients of height >158 cm affected more with renal calculus. When female patients of height <158 cm compared with female patients of height >158 cm, there was significant difference showing more affected with renal calculus, having height <158 cm. When male and female patients of height >158 cm compared with each other, male patients were affected more with renal calculus. Pearson’s correlation was calculated with weight and number of patients and BMI and number patients. Both showed a strong correlation (r=1).

Discussion

The incidence and prevalence of kidney stone disease are increasing while there has been a parallel growth increasing in the rate of obesity. Epidemiologic studies have shown a significant association between excess body mass and nephrolithiasis risk [5]. In our study, 50% of patients had overweight, compared with 30% of normal weight. Therefore, we hypothesized that being underweight may be a risk factor for renal stone incidence in the rural area. Although we did not find any difference between below healthy range and normal range or above healthy range and normal range separately. It is clear that body weight 56kg or more male patients (36%) affected more with renal calculus in compare with female patients (12%). It is our finding that less height female patients (<158 cm) affected more (42%) with renal calculus than male patients (17%) of the same height. Male patients (46%) of more height affect more with renal calculus than less height male patients (17%) as was in our case. It is clear that female patients of less height (42%) affect more with renal calculus than female patients of more height, as was in our study. Height may have an influence on renal calculus because in our study male patients of height >158 cm were affected more than female with a significant difference.

It has been documented that causes of renal stones are multifactorial [8]. Our study was concerned with not only being above healthy range as a risk factor for the renal stone. We found a significant number of patients with BMI outside the normal range were affected with renal stone. It is well known that several metabolic activities that favor stone formation have a strong dependence on an environment and nutritional factors. Medical conditions, such as Inflammatory Bowel Disease, Hyperparathyroidism, Chronic diarrhea, have a higher risk of kidney stone [9,10,11]. Research has been conducted in elucidating markers or other factors that might predict kidney stones in relatives; none has yet been clearly identified. A family history of gout is another risk factor for persons vulnerable to stones. Lifestyle including dietary factors and environmental factors such as, minerals in local drinking water or both may contribute to geographic differences that have been observed in the occurrence of kidney stones around the globe [12,13]. Long-term use of medications such as antacids, which change the acidic content of urine, may also increase the risk for kidney stones. A family history of kidney stones increases one’s risk for the condition [14,15]. A study suggested that stress may be a risk factor for stone formation, a condition which causes and increases vasopressin release, resulting from concentrated urine [16].

Metabolic disease and chronic diarrhea decrease body weight and patients with small body habitus people are affected with renal calculus. Medical conditions, such as Cohn’s disease, UTI, renal tubular acidosis, hyperparathyroidism, modularly sponge kidney. Dent’s disease, have also been known to lead to kidney disease [17,18,19]. All those medical conditions decrease body weight, decrease urinary output and some lithogenic substances pass with urine causing renal stone. Digestive disease and few surgeries, such as gastric bypass surgery, chronic diarrhea can cause changes in the digestive process that affect absorption of calcium and water, increasing the level of stone-forming substances in the urine [20,21,22,23,24]. Thus far, it is not clear whether being underweight and overweight are directly related with renal calculus. We found a significant difference in having overweight and normal-weight and the rate of renal calculus. In our study patients, 48% patient’s body weight was more than 56Kg. Body weight and BMI are directly correlated with each other, which also depends on nutrition. In a study, it was shown that low protein diet, dehydration, use of goat milk and poor socioeconomic conditions were major risk factors for bladder stones [25]. On the other hand, 52% of our study patients’ body weight was less than 56 kg who suffered from renal stone. They were all lean and thin bodied. We did not evaluate them for metabolic abnormalities or for other causes which can decrease BMI, but it is our speculation a good number of patients’ having abnormal BMI suffered from renal stone. It is suspected that a substantial % of this village population suffered from malnutrition or gastrointestinal problems. Although we did not determine those factors which cause the decrease of body weight, our study demonstrated that increasing BMI, 56kg or more body weight and more height, have a positive correlation with renal calculus. Another finding is that male patient having a weight of 56kg or more have more prevalence of renal stone (36%) than patients having a weight less than 56kg (27%).
Conclusion

This study demonstrates higher incidences of urinary calculi among patients having overweight, predominantly males. Consequently, male patients with a body weight of 56kg or more suffered more from urinary calculus. We conclude that BMI and body weight of 56kg or more do have an influence on urinary calculus disease. More weight male patients are affected more with renal calculus than female patients of the same weight with a significant difference. More height male patients are affected more with renal calculus than female patients with a significant difference. In the case of female, short body structure has an influence on the renal stone formation with a significant difference.

References