



## An Overview of Recurrent Renal Calculi and Its Management

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### Abstract

**Introduction:** Renal calculi are one of the most painful, commonest urological diseases. Life-time risk due to renal calculi is approximately 12% in men and 6% in women. Recurrence rate is reported as 50 % at 5 years, 80-90 % at 10 years. This study aimed at overview of recurrent renal calculi and its management.

**Methods and Materials:** It is a prospective, retrospective observational study conducted in a private hospital located in Warangal city of Telangana. A total of 2056 recurrent renal calculi patients were identified during the study period of 8 months

**Results:** During this period, a total of 2056 cases between age group of 0-90 years were collected. Among 2056 recurrent renal calculi patients, 1386 patients were counselled and 670 patients were not-counselled. Among 670 patients who received pharmacological treatment, reduction of symptoms was found in 642 patients and reduction in stone size was found in 296 patients. Among 1386 patients who received pharmacological treatment along with non-pharmacological treatment, reduction of symptoms was found in 1214 patients and reduction in stone size was found in 1137 patients.

**Conclusion:** Patients who received conservative treatment along with non-pharmacological treatment had developed greater reduction in symptoms, stone size, and recurrence compared to patients who received conservative treatment only. Proper fluid intake; dietary management and life style changes will be helpful in reducing stone size and recurrence of stones.

**Keywords:** Recurrent renal calculi, Lifestyle modifications, Conservative treatment, Non-pharmacological treatment.

### Introduction

Kidney stones are hard pebbles that develop from crystals that form in urine and build up on the inner surfaces of the kidney, in the renal pelvis, or in the ureter. The process of stone formation depends on urinary volume, concentrations of calcium, phosphate, oxalate, sodium, uric acid

ions, concentrations of natural calculus inhibitors (E.g. citrate, magnesium) and urinary pH.<sup>1</sup> Clinical manifestations includes flank pain radiating inferiorly and anteriorly, vomiting, nausea, hematuria, urinary frequency, urinary urgency, infection, stranguria, back pain, fever, abdominal discomfort, and dysuria.<sup>2</sup> Diagnostic

procedures include Helical CT, Ultrasonography, Radiography, KUB X-RAY, and IVP.<sup>3</sup> Treatment options include medications Alkaline citrates, Thiazides, NSAIDS, Uricosuric agents, Anti-emetics, Anti-diuretics, Antibiotics, Alkalinizing agents, Corticosteroids, Calcium channel blockers, Alpha blockers and surgical procedures include Stent placement, PCNL, URSL, ESWL, open nephrostomy.<sup>2</sup> Home remedies which prevents kidney stones include Water, Onion decoction, Lemon juice with Olive oil, Lemon juice with honey or black salt, Pomegranate, Coconut water, Apple Cider Vinegar, Okra (Lady's finger), Kidney Beans, Horse gram, Organic Celery, Red Apple, Basil, Watermelon, Radish, Vegetable Proteins, Figs (Anjir), Citric Fruit Juices, Pineapple juice, Cinnamon, Grapes, and Aloe Vera.<sup>4</sup>

Globally, kidney stone disease prevalence and recurrence rates are increasing .It affects about 12 % of the World population at some stage in their life time. It affects all ages, sex, and race but occurs more frequently in men than women within age of 20-49 years.<sup>5</sup> Recurrence rate after formation of initial stone is reported to be as high as 50% at 5years and 80-90% at 10 years.<sup>6</sup> Prevention of renal stone recurrence remains to be a serious problem in human health.<sup>5</sup>

Risk factors for recurrence include people who eats a high-protein, low-fiber diet, alcohol consumption, smoking, mixed diet or non-adherence to diet, inactive or bed-bound, family history of kidney stones, several kidney or urinary tract infections, past medical history of kidney stone, particularly if it was before age 25, people who have only one fully working kidney, people who had an intestinal bypass or a condition affecting the small intestine, such as Cohn's disease, sarcoidosis, hypercalciuria, hyperoxaluria, hyperparathyroidism, hypocitraturia, and hyperuricosuria. Medications which induce kidney stones include Aspirin, antacids, diuretics (reduce fluid build-up), certain antibiotics, antiretroviral medication , anti-epileptic medication.<sup>7</sup> General measures to prevent recurrent stone formation

include increase fluid intake to maintain urine output of 2-3lit/day,<sup>8</sup> decrease intake of animal protein ( $\leq 52$ grams/day), restrict salt intake ( $\leq 50$ mmol/day of sodium chloride), normal calcium intake ( $\geq 30$ mmol/day)<sup>9</sup>, decrease dietary oxalate<sup>10</sup>, and increase intake of Cranberry juice.<sup>11</sup>

### **Guidelines for the Management of Recurrent Kidney Stones<sup>7</sup>**

#### **Diet Therapies**

Fluid intake that will achieve a urine volume of at least 2.5 liters per day is considered appropriate. Patients with calcium oxalate stones must limit intake of oxalate-rich foods and maintain normal calcium consumption. Patients with calcium stones and relatively low urinary citrate must increase their intake of fruits and vegetables, limit non-dairy animal protein. Patients with uric acid stones or calcium stones and relatively high urinary uric acid must limit intake of non-dairy animal protein and patients identified with cysteine stones are to limit sodium and protein intake.<sup>7</sup>

**Pharmacologic Therapies:** Thiazide diuretics are preferred in patients with high urine calcium and recurrent calcium stones. Potassium citrate therapy is recommended to patients with recurrent calcium stones and low urinary citrate, Allopurinol to patients with recurrent calcium oxalate stones who have hyperuricosuria and normal urinary calcium. Cysteine-binding thiol drugs such as alpha-mercaptopyronylglycine are recommended to patients with cysteine stones who are unresponsive to dietary modifications and urinary alkalization, or have large recurrent stone burdens, acetohydroxamic acid to patients with residual or recurrent struvite stones only after surgical options have been exhausted.<sup>7</sup>

**Measures to Avoid Recurrence:** Patients must avoid high salt content food, do moderate exercise, eat more fruits, vegetables, avoid unhealthy foods like sugar, sugary drinks like sodas, energy drinks, processed food, alcohol, especially dark beers, black tea, chocolate based

beverages and foods with high levels of oxalates. Food such as meat, fish, eggs and poultry are likely to increase the amount of acid in urine. Foods high in magnesium prevent calcium from combining with oxalates and thus prevent stones from forming. Some foods like avocados, bananas, green leafy vegetables and pumpkin skins are beneficial. A healthy balanced diet is the best way to stay healthy and prevent kidney stones.<sup>4</sup>

### Methodology

A Prospective and retrospective observational study conducted for a period of 8 months in a 100 bedded private hospital. Study criteria includes patients who had previous history of kidney stones, early diagnosis of kidney stone size more than 5mm, patients who had conservative treatment and surgery for kidney stones and who had recurrent episodes of kidney stones. Pregnant women and patients who had early diagnosis of stone size less than 5mm were excluded from the study. Source of data includes patient medical records, current and previous case sheets and prescriptions, laboratory, radiological records and direct communication with patients and caretakers by asking a questionnaire which contains demographics, past medical, surgical history, family history, clinical presentation, number of recurrent stone events, BMI, allergies, co-morbidities, social history, dietary habits, fluid intake, provisional diagnosis, laboratory investigations, diagnosis, treatment, discharge medication and follow-up information. Results were carried out by dividing study population into 2 groups, one group of people who received pharmacological treatment and another group of people who received counseling regarding non-pharmacological treatment along with pharmacological treatment.

### Results

Among 2056 patients, the most exposed group for recurrent stones was found to be 31-40 years (24.7 %), male (1315- 63.95 %) were more affected

than female (741- 36.05 %), 1320 patients were alcoholics and 1167 patients were smokers, and the most exposed stone type was found to be calcium oxalate stones (1284- 62.45 %), followed by uric acid stones (294- 14.29 %). People living in rural area (1484- 72.17 %) were most exposed than people living in urban area (572- 27.83 %). Among 2056 patients, (886- 43.03 %) has normal BMI, (597-29.03 %) has higher BMI and (573-27.88 %) has lower BMI. Among 2056 patients, 189 female and 366 male were consuming less than 1lit/day, 242 female and 392 male were consuming less than 2lit/day, 261 female and 447 male were consuming less than 3lit/day, 47 female and 98 male were consuming less than 4lit/day and 2 female and 12 male were consuming more than 4lit/day. Among 1315 male, 2 were totally vegetarians, 51 were totally non-vegetarians, and 1262 were on mixed diet. Among 741 females, 5 were totally vegetarians, 7 were totally non-vegetarians, and 729 were on mixed diet. Among 2056, the most exposed co-morbidity was found to be obesity (595- 28.97 %). Among all surgical types, the most exposed surgical type for recurrent renal calculi was found to be ESWL, of 61 ESWL Surgeries, 34 were recurrent cases (72.91 %). Among 2056 patients, 723 patients had two episodes of stones, 528 patients had three episodes, 448 patients had four episodes, and 357 patients had five episodes. Among 2056 recurrent renal calculi patients, 1386 patients were counseled and 670 patients were not-counseled. Among 670 patients who received pharmacological treatment, reduction of symptoms was found in 642 patients and reduction in stone size was found in 296 patients. Among 1386 patients who received pharmacological treatment along with non-pharmacological treatment, reduction of symptoms was found in 1214 patients and reduction in stone size was found in 1137 patients.

### Discussion

In this present study, 2056 recurrent renal calculi cases were collected. Major triggering factors for

stone recurrence were life style, diet and fluid intake, work environment, stress, social habits, being obese, co-morbidities like hyperparathyroidism, diabetes, hypertension which leads to metabolic changes. Among 2056, 670 patients received pharmacological treatment, but not counseling and 1386 were received non-pharmacological treatment include counseling regarding lifestyle changes, fluid intake, dietary habits, social habits, use of home remedies along with pharmacological treatment. Among 670 patients who received pharmacological treatment, reduction of symptoms was seen in 642 patients and reduction of stone size was seen in 296 patients. Among 1386 patients, who received non-pharmacological treatment along with pharmacological treatment, who followed counseling regarding lifestyle changes, fluid and diet intake, reduction of symptoms was seen in 1214 patients and reduction of stone size was seen in 1137 patients. Impact of non-pharmacological treatment along with pharmacological treatment was observed to be greater compared to pharmacological treatment alone.

In this study, recurrence according to stone type was 54 % for calcium stones, 25 % uric acid stones, 22 % for infection stones, 60 % mixed stones. This is similar to a cross sectional study conducted in 160 patients referred to lithotripsy center of Illam where in rate of recurrence according stone type was 27 % for calcium (40 out of 107cases), 20 % for infection stones (6 of 29), 23 % for uric acid stones, and 50 % for mixed stones.<sup>13</sup>

In our study, majority of people who identified with higher BMI were at greater risk of stone formation and recurrence. Most of them were on high salt and high protein diet which predispose them to stone formation. This is similar to a study conducted by Curhan GC *et.al*, where he found the association between the body size (height, weight, body mass index) and the risk of kidney stone formation. The results from this study suggest that body size is associated with the risk of stone formation.<sup>15</sup>

We found that people who were advised to drink more water had developed stone size reduction comparatively. Lower water intake causes urine super saturation which leads to stone formation. This is similar to a study conducted by Yoshimura *et.al*, explained that increased fluid intake significantly decreases stone formation.<sup>14</sup>

In our study, counseling to patients regarding general preventive measures for stone recurrence was done by following EUA guidelines. According to EUA guidelines, general preventive measures for stone recurrence includes fluid intake: 4.5-5.0 L/day, a balanced diet constituting vegetables and fiber, normal calcium content: 1-1.2 g/day, limited NaCl content: 4-5 g/day, limited animal protein content: 0.8-1.0 g/kg/day, lifestyle advice to normalize general risk factors like BMI, adequate physical activity, balancing of excessive fluid loss, avoiding excessive consumption of vitamin supplements.<sup>7</sup> Patients who followed these counseling points have developed gradual decrease in stone formation and recurrence.

In our study, suggesting the use of natural remedies to prevent kidney stones helped to reduce stone recurrence. This is similar to a study conducted by Shibani R *et.al*, explained about natural remedies to prevent stone recurrence. Home remedies which have greater benefit in reduction of kidney stones includes water, onion decoction, lemon juice with olive oil, lemon juice with black salt and honey, holy basil tea, coriander seeds tea, coconut water, apple cider vinegar, pomegranate, aloe Vera etc.<sup>4</sup>

### Conclusion

In this study, among 2056, 1315(63.95 %) were male and 741(36.05 %) were female. Most of the patients were farmers from rural area having social habits like smoking and drinking. Daily water intake is 1000-1500 ml in most of the patients. Most of the patients were following mixed diet. Major predisposing factors for stone recurrence were life style, diet and fluid intake, work environment, stress, social habits, obesity, co-morbidities such as hyperparathyroidism,

diabetes, hypertension which lead to metabolic changes. Non-pharmacological and pharmacological treatments have impact in reduction of stone size and prevention of recurrence. Patients who received pharmacological treatment had great reduction in symptoms but less reduction in stone size and formation. Patients who received pharmacological and non-pharmacological treatment had developed greater reduction in symptoms, stone size and recurrence. Less fluid intake, high protein and salt intake, high oxalate intakes are the main reasons for metabolic changes, urine super saturation and stone formation. This study concluded that proper fluid intake, dietary management and life style changes, and home remedies will be helpful in reducing stone size and recurrence of stones.

### Abbreviations

pH – Potential Hydrogen

CT – Computed Tomography

KUB x-ray – Kidney, ureters, bladder x-ray

IVP – Intravenous Pyelogram

NSAIDS – Non-steroidal anti-inflammatory drugs

PCNL – Percutaneous Nephrolithotomy

URSL – Ureteroscopic Lithotripsy

ESWL – Extracorporeal Shock Wave Lithotripsy

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