

STUDY OF QUALITY OF LIFE OF PATIENTS WITH RENAL CALCULI

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Abstract

Kidney stones are responsible for about 3.66 million medical consults each year with treatment costing about \$2 billion annually in medical bills. The main objective of the study was to analyze the quality of life of patients by existing renal calculi. The study would be focused on providing better therapeutic, cost-effective and safe treatment in renal calculi patients. The study was conducted in a urology department of Medcity Multi-Super Speciality Hospitals (400 bedded hospital), Medchal, Hyderabad, India. This study was conducted on 80 patients to study the quality of life of patients with renal calculi for the duration of 5 months and collected information from patients from 20-80 years of age. Divided the patient in different age groups, male-female, alcoholic-non alcoholic, working-nonworking, vegetarian-non vegetarian, married-unmarried and concluded that smoking, alcoholism etc. adversely affects the quality of life of patients of renal calculi. Moreover, vegetarian diet may also indirectly help to improve the quality life of the patients with renal calculi. Finally, it was found that, if the patient leads hygienic and disciplined life quality of such patients will be somewhat better.

Keywords: Renal calculi, Red brown organ, ureter, urinary bladder and renal hilus.

Introduction

The kidneys are a pair of bean shaped, red brown organ, whose function is to dispose of the waste matter produced by the normal functioning of the body and to keep the salts and water of the body in the correct balance. The kidneys are located at the back of the abdomen, one on each side of the spine, at the level of the lowest ribs. Because of the position of the liver, the right kidney is located slightly lower than the left. Each kidney is joined with the

ureter, the tubes that conduct urine to the bladder. At the centre on one side of each kidney is an indentation known as the renal hilus, the exit point for the ureter and the location where nerves, blood and lymphatic vessels enter and exit. Enclosing each kidney is a protective membrane, the renal capsule. Surrounding each capsule is a cushion of fatty tissue and a layer of connective tissue which attaches kidney to the back of the wall of the abdomen. An adrenal gland sits on top of each kidney¹. The bladder muscle (detrusor muscle) is capable of distending to accept urine without increasing the pressure inside; this means that large volumes can be collected (700-1000 ml) without high-pressure damage to the renal system. When urine is passed, the urethral sphincter at the base of the bladder relaxes, the detrusor contracts, and urine is voided via the urethra².

Structure of the Kidney

Each kidney has an outer layer – the cortex, an inner layer – the medulla, and a pelvis, a hollow inner structure that joins with the ureters. The renal medulla contains between 8 and 18 renal pyramids with a striped appearance. The pyramids are positioned with their tips, the renal papillae, facing towards the renal hilus and their bases aligned with the edge of the renal cortex. The cortex continues in between each pyramid creating areas known as renal columns³.

Structure of the Nephron

The functional units of the kidneys are microscopic structures called nephrons, of which there are estimated to be 1.2 million in each kidney. Each nephron has a renal corpuscle, which lies in the renal cortex, and a renal tubule which runs through a renal pyramid. The renal corpuscle is comprised of an extensive ball shaped capillary network called the glomerulus surrounded by a double walled cup of epithelial tissue- the glomerular or Bowman's capsule. Together, these structures filter the blood, producing a liquid (the filtrate) containing minerals, wastes and water⁴.

Renal Stones

A kidney stone, also known as a renal calculus (from the Latin *rēnēs*, "kidneys" and *calculus*, "pebble") is a solid concretion or crystal aggregation formed in the kidneys from dietary minerals in the urine. Among the different types of kidney diseases, renal calculi are common and a major cause of morbidity. Kidney stones are responsible for about 3.66 million medical consults each year with treatment costing about \$2 billion annually in medical bills⁵.

Kidney Stone Formation

A stone can form only when urine is supersaturated with respect to its constituent crystals. Urine of most normal people is supersaturated with respect to calcium oxalate, so in principle, all people can form such stones.

However, normal urine is not supersaturated with respect to uric acid, cystine or struvite. Conditions that raise calcium oxalate super saturation raise the risk of calcium oxalate stones. Super saturation creates stone by causing ions in solution to combine with one another into a solid phase, a process called nucleation. Calcium and oxalate ions can orient themselves on surfaces of another crystal, such as uric acid, and such heterogeneous

nuclei may promote calcium oxalate stones. The disorders that raise super saturation and promote heterogeneous nucleation are the presently accepted causes of nephrolithiasis; their diversity and the diversity of their current treatments complicate clinical management of patients and offer many opportunities for fruitful research. At the same time, there are other factors that may influence stone forming propensity, such as inhibitors of calcium oxalate crystallization and urothelial surface properties that affect crystal retention; variations of inhibitors and urothelial surface properties may partly explain why only a small fraction of people form calcium oxalate stones even though urinary calcium oxalate super saturation is almost universal. Assessment of inhibitors and urothelial surface properties are not yet applicable to clinical practice, but may eventually transform it⁶.

Risk factors for kidney stone formation

Sex and age, Body size and mass, Hereditary or personal history of renal stone, Geographic conditions, Life style factors, Calcium, Magnesium, Phosphorus, Protein, Potassium, Sodium, Fluids, Vitamin C, Fatty / High Caloric food, Fluoride, Associated diseases, Bowel disease, Urinary tract diseases, Diabetes mellitus, Surgeries, Spinal cord injury, Others Medications, Oxalate foods are high in oxalate (greater than 10 mg per serving): Beans in tomato sauce, Beer, Beets, Blackberries, Black and red raspberries, Blueberries, Celery, Chard, Chocolate, Cocoa, Coffee powder, Collards, Concord grapes, Crackers made from soy flour, Currants, Dandelion greens, Eggplant and these foods are moderately high in oxalate (2–10mg per serving): Apple, Apricots, Asparagus, Bottled beer, Broccoli, Carrots, Chicken noodle soup, Coffee, Cola beverage, Corn, Cornbread, Cucumber, Lettuce, Lima beans, Marmalade, Oranges, Orange

juice, Parsnips, Peaches, Pears, Peas, Pepper, Pineapple, Plums, Prunes, Sardines, Soy products, Sponge cake, Tomatoes, Tomato juice, Turnip and Watercress⁷.

Types of Kidney Stones

Kidney stones are made of different types of crystals. Most are (1) calcium stones viz., calcium oxalate, calcium phosphate or a combination of calcium oxalate and calcium phosphate. (2) magnesium ammonium phosphate, also known as struvite or infection stones. (3) uric acid. (4) cystine, and (5) miscellaneous types such as occur with drug metabolites⁸.

Symptoms

Many kidney stones don't move and are too small to cause any symptoms. However, if a kidney stone causes a blockage, or moves into the ureter, it may cause some of the following symptoms: severe pain or aching in the back on one or both sides, sudden spasms of excruciating pain (renal or uterine colic); this usually starts in the back below the ribs, before radiating around the abdomen and sometimes to the groin and genitalia, bloody, cloudy or smelly urine, feeling of being sick, a frequent urge to urinate or a burning sensation during urination

- fever and chills, nausea and vomiting,

These can also be symptoms of a urinary tract infection or cystitis, which is much more common than kidney stones in young women. Kidney stones are usually passed out of the body within 48 hours, but attacks can sometimes last for over 30 days⁹.

Diagnosis

Doctors can usually diagnose kidney stones by asking about symptoms and examining patient. Further tests may be done to confirm the diagnosis and to reveal the size, location and type of stone. These include: Blood tests, Urine analysis, Taking an X-ray image, An intravenous urogram (IVU), Abdominal

Ultrasonography, Plain Film Radiography and Non-contrast helical computerized tomography⁹.

Prevention

More fluid i.e. at least three liters every 24 hours or enough to make urine clear rather than a yellow color, helps in preventing any type of kidney stone. A diet low in protein, nitrogen and sodium, avoiding excess Vitamin C, especially Vitamin C supplements, restriction of oxalate-rich foods and maintenance of an adequate intake of dietary calcium can help in prevention of kidney stones. Though caffeine does acutely increase urinary calcium excretion, several independent epidemiologic studies have shown that coffee intake overall is protective for stones. Measurements of food oxalate content have been difficult and issues remain about the proportion of oxalate that is bio-available, versus a proportion that is not absorbed by the intestine. Oxalate-rich foods such as chocolate, coffee, cola, nuts, strawberries, white bran tea, tomatoes, rhubarb, cooked spinach, asparagus, etc are usually restricted to some degree, particularly in patients with high urinary oxalate levels, but no randomized controlled trial of oxalate restriction was performed to test that hypothesis. But recently some scientist proved that oxalate intake and spinach were not associated with risk in younger women and dietary sources of oxalate can induce hyperoxaluria and crystal deposition in the kidneys with associated degradation in renal biology. Eliminating oxalate from the diet decreases not only urinary oxalate, but also calcium oxalate crystal deposits in the kidneys and improves their function. Though the Spirulina diet alone did not induce any features relating to stone forming condition suggesting that free radical release might have been suppressed due to enrichment of dietary antioxidants and vitamins. However, it has been demonstrated that during hyperoxaluric

conditions the Spirulina diet must possibly be avoided and can be considered in normal subjects checked for family history of renal stone deposition. Reducing the amount of calcium in diet lowers the risk of developing calcium stones. However, research has shown that a diet containing normal or even increased amounts of calcium containing food (such as dairy products or green leafed vegetables) may be more helpful. High intake of dietary calcium appears to decrease risk for symptomatic kidney stones, whereas there is equivocal evidence that calcium supplements increase the risk of stone formation, though calcium citrate appears to carry the lowest, if any, risk. Because dietary calcium reduces the absorption of oxalate, the apparently different effects caused by the type of calcium may be associated with the timing of calcium ingestion relative to the amount of oxalate consumed. However, other factors present in dairy products (the major source of dietary calcium) could be responsible for the decreased risk seen with dietary calcium. It has been speculated that calcium supplement in subjects with low oxalate intake might increase the risk of calcium stone formation due to an increase in calcium absorption without a significant reduction in oxalate absorption. Taking calcium supplements resulted in a reduction in urinary oxalates and an elevation in urinary citrates. Both alterations in urinary constituents counterbalanced the elevation in urinary calcium which resulted from the calcium supplements. Dietary phylate may be a new, important, and safe addition to our options for stone prevention. L-Arg supplementation may decrease free radicals and tubular membrane injury in nephrocalcinosis due to infiltrating leukocytes and decreased antioxidant enzyme activities as proved in rats fed with EG diet. L-Arg act as a potent antilithic agent, by increasing the level of

citrate in the hyperoxaluria-induced rats and decreasing calcium oxalate binding to the THP. L-Arg also effectively prevents the deposition of calcium oxalate crystals by curtailing the renal epithelial damage and protein oxidation as evidenced by the normal activities of urinary marker enzymes in l-arg supplemented hyperoxaluric rats. Dietary salt intake has long been known to contribute increased calcium loss in the urine in both normal subjects and in those with hypercalciuria. A study of normal subjects found that increasing dietary salt from 50 to 250 mmol/day increased urinary calcium from 2.73 to 3.93 mmol/day or 44%. This increase in salt intake also significantly reduced urinary citrate from 3.14 to 2.52 mmol/day or about 20%. As a result of this increase in calcium and decrease in citrate the tendency for calcium phosphate, uric acid and calcium oxalate to crystallize all increased significantly. Decreased intake of meat, fish and poultry like protein rich food can avoid uric acid stones. Maintaining hygienic conditions and keeping urine free of the bacteria can help prevent struvite stones. Potassium citrate is also used in kidney stone prevention. This is available in tablet and liquid formulation. The medication increases urinary pH (makes it more alkaline), as well as increases the urinary citrate level, which helps reduce calcium oxalate crystal aggregation. Optimal 24 hour urine levels of citrate are thought to be over 320 mg/liter of urine or over 600 mg per day. There are urinary dipsticks available that allow patients to monitor and measure urinary pH so patients can optimize their urinary citrate level. For those patients interested in optimizing their kidney stone prevention options, it's essential to have a 24 hour urine test performed. This should be done with the patient on his or her regular diet and activities. The results can then be analyzed for abnormalities and appropriate treatment given. Though not a

"cure", ease can sometimes be found during "mild" pain by walking (if possible), preferably in cold air. Some pain relief may also be derived by soaking in a hot tub of water¹⁰.

Treatment

Knowing the composition of the calculus is of importance for a more complete evaluation of the metabolic study. The nature of the calculus in fact helps the physician to find a convenient metaphylaxis consisting of both sanitary and therapeutic measures. Study of the composition of urinary stones remains one of the most interesting aspects of the lithiasic pathology today. X-ray analysis was found to exceed X-ray diffraction and infrared spectroscopy in its sensitivity for the identification of stone components several fold. This was largely due to the inability of the latter methods to detect apatite in more than half of the apatite containing stones. The findings in X-ray analysis had the best correlation with chemical analysis, which was applied mainly to the detection of apatite. Initially, conventional radiography using X-ray imaging was used to know stone composition. Presently crystallographic examination constitutes one of the most precise and less expensive methodologies to identify the nature of the concretion. This method also allows the urologist to catalogue the typology of the lithiasis during endoscopy. Sequential changes of the compositions of recurrent calcium calculi are highly likely to occur with time in individual recurrent calcium stone formers with calcium oxalate monohydrate found to be a most common component of the studied recurrent calcium stones. Treatment depends on the type and cause of the stone. The kidney stone can be collected by passing urine through filter paper or a tea strainer. The stone can then be analyzed to find out what type it is to help guide treatment. Simple trigonometry on Computed Tomography of the patients

with complex stones could help endourologists in planning renal access. It increases the stone-free rate up to 92.6% without any chest-related complications. Patient may be prescribed paracetamol or codeine to reduce the pain. Supplementation with magnesium, a smooth muscle relaxant, can help reduce pain and facilitate stone passing. However, if there is an infection, a blockage, or a risk of kidney damage, patient will receive treatment to remove stone. Infections can be treated with antibiotics. During recent decades, pharmacologic intervention has become more effective in stone disease: drugs can control the pain of renal colic, interfere at various levels in lithogenesis, and contribute to the expulsion of stones¹¹. The main objective of the study is to analyze the quality of life of patients by existing renal calculi. The study would be focused on providing better therapeutic, cost effective and safe treatment in renal calculi patients¹¹.

Materials and Methods

Study Design

An observational study of subjects who under went renal calculi medication and/or surgery, Informations from individual patients were put together and analyzed by using different types of scoring scales and Pharmacoepidemiological consideration¹².

Study Site

The study will be conducted in urology department of Medcity multi-Super Speciality Hospitals, which is a 400 bedded hospital¹³.

Study Period

This study is proposed to be conducted for the duration of 5 months¹⁴.

Study sample size

Data is collected from 80 patients to study the quality of life of patients with renal calculi¹⁵.

Selection of Patients

Inclusion Criteria

1. Patients with renal calculi, 2. Inpatients and outpatients of Medcity hospitals, 3. Subjects from other hospitals coming for follow up to Tulasi hospitals, 4. Subjects who are willing to participate, 5. Subjects of all ages and 6. Subjects of both sex¹⁶.

Exclusion Criteria

1. Patients of other hospitals, 2. Patients without renal calculi and 3. Subjects who are not willing to participate¹⁷.

Collection of data

The data will be collected through patient interaction, Questionnaires and from Medical Record Department, Conducted the study for a period 5 months (January

2016 to May, 2016 on a regular basis, Met the patients in the department of Urology and Nephrology and interacted with them as per the standard questionnaire, Collected the name of the patient, contact no and other lifestyle related information's, Also met the medical record department (MRD) and collected informations of the patients from the concerned staff, Collected information from patients from 20-80 years of age, Have divided the patient in difficult age groups, male-female, alcoholic-nonalcoholic, working-nonworking, vegetarian-nonvegetarian, married-unmarried etc¹⁸.

Results and Discussion

As per observational study of married people, quality of life of male patients is much better than that of the female patients. In case of unmarried patients similar observation came i.e. Quality of life of male patient is much better compared to female patients as shown in Table 1.

Table 1 Quality of life of patients with renal calculi based on marital status

	Married			Un married			
	Male	Female	Total (100%)		Male	Female	Total (100%)
Excellent	0	0	0	Excellent	0	0	0
Good	16(61.53%)	10(38.4%)	26	good	05	0	05
Average	18(66.6%)	09(33.3%)	27	Average	01	0	01
Poor	01	0	01	poor	0	0	0
Total	35(64.8%)	19(35.1%)	54	Total	06	0	06

Separately, studied the quality of life in gender variation i.e. Male and female patients with renal calculi considering married or unmarried information also;

here also quality of life is much better in case of male patient compared to female patients as shown in Table 2.

Table 2 Quality of life of patients with renal calculi based on gender status

	Male	Female	Total (100%)
Excellent	0	0	0
Good	21(67.7%)	10(32.2%)	31
Average	19(67.85%)	09(32.1%)	28
Poor	01	0	01
Total	41(68.3%)	19(31.6%)	60

Also studied the quality of life of patients in various age groups starting 20-80 years as shown in Table 3, Here in the age group of 20-30 years, qualities of life of patients is much better in case of male than that of females. It may be due to some genetic factors & life style, In the age group of 30-40 years similar quality of life of patients observed in male & female patients. In case of age group of 40-50 years quality of

life of female patients of the same age group we observed similar results i.e. quality of life is better in male patients than female patients of the same age group. In the age group of 60-70 years, male patients are more prone to renal calculi than female patients in the same age group. It may be due to some genetic factors and life style factors also like smoking, alcoholism etc.

Table 3 Quality of life of patients with renal calculi based on age group (Years)

	Male					Female				
	Excellent	Good	Average	Poor	Total (100%)	Excellent	Good	Average	Poor	Total (100%)
10-20	0	01	0	0	01	0	0	0	0	0
20 ⁺ -30	0	6(75%)	2(25%)	0	08	0	05(83.3%)	01(16.7%)	0	06
30 ⁺ -40	0	8(47%)	9(52.9%)	0	17	0	03(50%)	03(50%)	0	06
40 ⁺ -50	0	2(25%)	6(75%)	0	08	0	0	01(20%)	4(80%)	05
50 ⁺ -60	0	2(66.6%)	01(33.4%)	0	03	0	01(50%)	01(50%)	0	02
60 ⁺ -70	0	2(50%)	01(25%)	01(25%)	04	0	0	0	0	0
Total	0	21(51.2%)	19(46.3%)	01(2.4%)	41		09(47.3%)	06(31.57%)	04(21%)	19

Alcoholism plays some important role developing renal calculi as shown in Table 4. It is clear that non-alcoholic patients are having a much better quality of life than alcoholic patients. It signifies that alcohol plays some indirect role in developing renal stones through some molecular mechanism.

Table 4 Quality of life of patients with renal calculi based on alcoholic status

Alcoholic				Non -alcoholic			
	Male	Female	Total (100%)		Male	Female	Total (100%)
Excellent	00	0	0	Excellent	0	0	
Good	06(85.7%)	01(14.3%)	07	Good	14(47.0%)	09(52.9%)	23
Average	15	0	15	Average	05(35.7%)	09(64.3%)	14
Poor	0	0	0	Poor	01	0	01
Total	21(95.4%)	01(4.6%)	22	Total	20(52.2%)	18(47.3%)	38

In case of working and non-working patients, it was found that non-working patients are having comparatively better quality of life than that of working patients. It is probably due to sufficient rest and stress-free & journey-free life of non working patients as shown in Table 5. Moreover nonworking female patients are

having better quality of life than non working male patients. Again working male patients are having better quality of life than working female patients. It may be due to excess stress for working female patients to maintain jobs and family, children etc.

Table 5 Quality of life of patients with renal calculi based on working status

Working				Non –working			
	Male	Female	Total (100%)		Male	Female	Total(100%)
Excellent	0	0	0	Excellent	0	0	0
Good	13(92.8%)	01(7.2%)	14	Good	08(47.0%)	09(52.9%)	17
Average	17(80.9%)	04(19.0%)	21	Average	02(28.5%)	05(71.4%)	07
Poor	01	0	01	Poor	0	0	0
Total	31(86.1%)	05(13.8%)	36	Total	10(41.6%)	14(58.3%)	24

Besides, we also studied the food habit of the patient with renal calculi. It was found that non-vegetarian and mixed diet (veg & nonveg suffer more from renal stones than

purely vegetarian patients. It is probably be due to more production of urea through metabolism of protein diet in non-vegetarian patients as shown in Table 6.

Table 6 Quality of life of patients with renal calculi based on diet status

Vegetarian				Non-Vegetarian			Mixed diet		
	Male	Female	Total(100 %)	Male	Female	Total(100 %)	Male	Female	Total(100 %)
Excellent	0	0	0	0	0	0	0	0	0
Good	0	02	02	01	0	01	21(67.7 %)	10(32.2 %)	31
Average	0	0	0	0	0	0	18(72.0 %)	07(28.0 %)	25
Poor	01	0	01	0	0	0	0	0	0
Total	01(33.33 %)	02(67.0 %)	03	01	0	01	39(69.6 %)	17(30.3 %)	56

Also observed that maximum patients with renal calculi are treated with medicines and some are under gone surgery depending on particular case. It was found that quality of life of patients with treatment by medicines is comparatively

better than that of the patients under medicines and surgery both. If surgery can be avoided with medicines and other alternative modern therapy & quality of life of patients is somewhat better as shown in Table 7.

Table 7 Quality of life of patients with renal calculi based on medicine status

	Medicine			Surgery			Ayurvedic/herbal		
	Male	Female	Total (100%)	Male	Female	Total (100%)	Male	Female	Total (100%)
Excellent	0	0	0	0	0	0	0	0	0
Good	20(68.9%)	09(31.1%)	29	01	01	02	0	0	0
Average	12(60%)	08(40%)	20	06	0	06	01	01	02
Poor	0	0		0	0	0	01	0	01
Total	32 (65.3%)	17(34.6%)	49	07(87.5%)	01(12.5%)	08	02 (66.6%)	01(33.4%)	03

Conclusion

Depending on the advancement of the renal calculi as well as condition of the patient, physicians decide the treatment schedule with medicines and surgery etc. Genetic factors, age group, lifestyle also play significant role in the quality of life of such patients, smoking, alcoholism adversely affect the quality of life of patients of renal calculi. Food habit i.e. vegetarian diet may also indirectly help to improve the quality life of the patients with renal calculi and it was found that, if the patient leads hygienic and disciplined life quality of such patients will be somewhat better.

Conflict of interests

It is hereby acknowledged that there is no conflict of interests among authors regarding the submission of this manuscript.

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