

## ORIGINAL RESEARCH

### A clinical study to evaluate the complications and associated factors related to renal calculi patients: An original research study

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#### ABSTRACT:

**Background and Aim:** Renal calculi are crystal concretion formed usually within the kidneys. It is an ever increasing urological disorder of human health, affecting about 12% of the world population. The sole aim of this study was to evaluate complications of the cases of renal calculi in studied population. **Materials & Methods:** This study was conducted on 160 patients of renal stones of both genders. Patient's parameters such as age, gender, type of stones etc. were recorded. Ultrasonography (USG) was performed in all patients. **Results:** Statistical analysis was attempted by software Statistical Package for the Social Sciences version 21. Out of 100 selected patients, males were 64 and females were 36. p value was reported to be significant for the age group of 45-50 (0.00, \*p<0.05 significant). Maximum patients (25) were falling in the age range of 46-50 years. Pain was reported in maximum cases (n=63) followed by hematuria, dysuria, anuria, fever, cramp. Up to 82% patients were having Calcium based calculi (Oxalate + Phosphate). Almost all the studied complications were noticed in 7 patients. Most of the primary therapy focused on waiting for its passing by itself. **Conclusion:** In the studied patients, most common type of renal calculi was calcium oxalate and calcium phosphate. Males were more affected than females. Pain was the most common symptoms followed by hematuria.

**Key words:** Nephrolithiasis, Chronic kidney disease, Renal calculi, Septicemia

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#### INTRODUCTION

As we all are aware that the exact etiology of kidney stone is usually multi-factorial. In many of the racial population across the globe, most common variety of kidney stone is calcium oxalate which is generally created on the surfaces of renal papillary. Many of the pioneer researchers have worked hard to define the mechanism of action of stone formation.<sup>1,2</sup> Most of them have come out with the inferences that it is primarily due to the series of complex process including various chemical cycles and cascades. Kidney stones are commonly called as renal calculi. Literature has well evidenced that humanity has been encroached by renal stones since centuries dating back to 3000 B.C.

Kidney or renal stones are the most common disease of the urinary tract as per literature till date.<sup>3,4,5</sup> It affects almost all age and sex groups. As prevention is better than cure so, sincere prevention of stone formation necessitates comprehensive understanding of the mechanisms involved in calculi creation. Furthermore, kidney stones have been found to be associated with a high risk of development of chronic kidney diseases. Other common complications of renal calculi include end-stage renal disease, cardiovascular diseases, diabetes and hypertension. Nephrolithiasis is one more term commonly used to address renal calculi. Many researchers have shown it as a wide-spreading disease affecting up to 6% of the general population in the

United States. However this rate of incidence is quite scary in south Asian region which is about 13%. In the south eastern region of Asia, the most common type of renal calculi result from higher excretion of calcium and oxalate in the urine. All such minerals fuse together as crystals thus creating calculi.<sup>6,7</sup> Our kidney's prime function is to filter the blood and remove the extra waste and water as urine. Kidney stones are usually created when few of the components of urine bind together to make a big lump. Depending upon their sizes, they cause different symptoms. Mostly, the larger sized calculi cause anatomical and morphological damage to kidney. If left untreated, eventually these conditions develop in to chronic kidney diseases.<sup>8,9</sup> Larger sized calculi can easily block the normal flow of urination. Such blockages can develop deleterious damages to kidney structure sometimes kidney failure. Renal calculi also increase the probability of urinary tract infection and kidney infection. Few of the infectious agents can travel through the blood circulation and resulting into septicemia.<sup>10,11</sup> In the light of the above intermingling facts, the sole aim of this study was to evaluate complications of renal calculi and associated factors in studied population.

#### **MATERIALS & METHODS**

The present study was conducted in the department of nephrology the institute. It included 100 known patients of renal stones of both genders. Purpose of the study was explained in details to all participants. Demographic details of the patients like age, gender etc. were gathered. We had ensured to study both males and females of the age group 30 to 60 years. For locating and specifying the renal calculi, ultrasonography (USG) was attempted in all selected patients (figure 1 & 2). Comprehensive history and USG recommendations were also explored for all subjects to assess the type of calculi, their sizes, location and related systemic complications. History taking involved questions like 'do you have a medical condition that may increase your chance of having stones, like frequent diarrhea, gout or diabetes, anyone in your family had stones, you had more than one kidney stone before.' Understanding your medical, family and dietary history usually helps your clinician provider find out how likely you are to form more stones. All gathered data was segregated as per complication, calculi, sexual provenances and age groups. The nature of the renal calculi was finalized by the available reports of urine biochemistry and microscopic examination of passed out calculi. Author has also attempted to explore about the commonest mode of treatment in the studied patients. Informed consent was taken from all participants to meet the

ethical criteria. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

#### **STATISTICAL ANALYSIS AND RESULTS**

All the recorded data and responses were gathered and sent for statistical evaluation using statistical software Statistical Package for the Social Sciences version 21 (IBM Inc., Armonk, New York, USA). The resulting data was subjected to suitable statistical tests to obtain p values, mean, standard deviation, chi-square test, standard error and 95% CI. Table 1 and Graph 1 illustrate that out of 100 patients, males were 64 and females were 36. Total 13 patients were reported to age group 30-35 years. Just 5 patients were falling in the age range of 56-60 years. Therefore we can presume that most of the renal calculi were related to the age range of 36-50 years. P value was reported to be significant for the age group of 45-50 (0.00, \*p<0.05 significant). Maximum patients (25) were falling in the age range of 46-50 years. P value was reported to be significant in second and fourth age groups. Males were more affected than females. Table 2 shows about fundamental statistical explanation with level of significance assessment using Pearson chi-square test for various complications related to renal calculi patients. P value was reported to be significant for hematuria, anuria, fever (\*p<0.05 significant). Graph 2 illustrates about the individual complications according to frequency of occurrence. Pain was reported in maximum cases (n=63) followed by hematuria (n=59), dysuria (n=36), anuria (n=23), fever (n=21), cramp (n=13). Graphical illustration of combination of complications according to frequency of occurrence has been shown in graph 3. For the ease of understanding of combinations of complications, author had numbered them from 1 to 6. The most fatal clinical scenario having almost all the studied complications were noticed in 7 patients. Graphical representation of renal calculi according to their nature has been discussed in graph 4. Up to 82 (82%) patients were having Calcium based calculi (Oxalate + Phosphate). One of the oxalate calculi of 2 mm size has been shown in figure 3 (morphological view). 8 patients were having uric acid calculi, 7 patients had struvite (infectious) calculi and 3 patients had mixed type of calculi. Most of the primary therapy focused on waiting for its passing by itself. This was the first line of treatment in almost all the studied patients. Smaller calculi are more likely than larger stones to pass on their own. Waiting four to six weeks for the calculi to pass is safe as long as the pain is bearable; there are no signs of infection.



Figure 1: Ultrasonography confirming renal calculi (calcium oxalate) of 2 mm size in left kidney. Calcium oxalatecalculi can be easily distinguished by the shape of the respective crystals.



Figure 2: Ultrasonography confirming renal calculi (calcium oxalate) of 2 mm size in right kidney. Calcium oxalate dihydrate crystals are octahedral while Calcium oxalate monohydrate crystals vary in shape, and can be shaped like dumbbells, spindles, ovals, or picket fences.



Figure 3: Renal calculi (calcium oxalate) obtained from one of the studied patient (morphological view)

**Table 1: AGE & GENDER WISE DISTRIBUTION OF PATIENTS**

Age Group (Yrs)	Male	Female	Total	P value
30-35	8	5	13 [13 %]	0.00
36-40	17	6	23 [23 %]	0.01*
41-45	11	5	16 [16 %]	0.08
46-50	16	9	25 [25 %]	0.01*
51-55	10	8	18 [18 %]	0.09
56-60	2	3	5 [5 %]	0.30
Total	64	36	100	<b>*Significant</b>

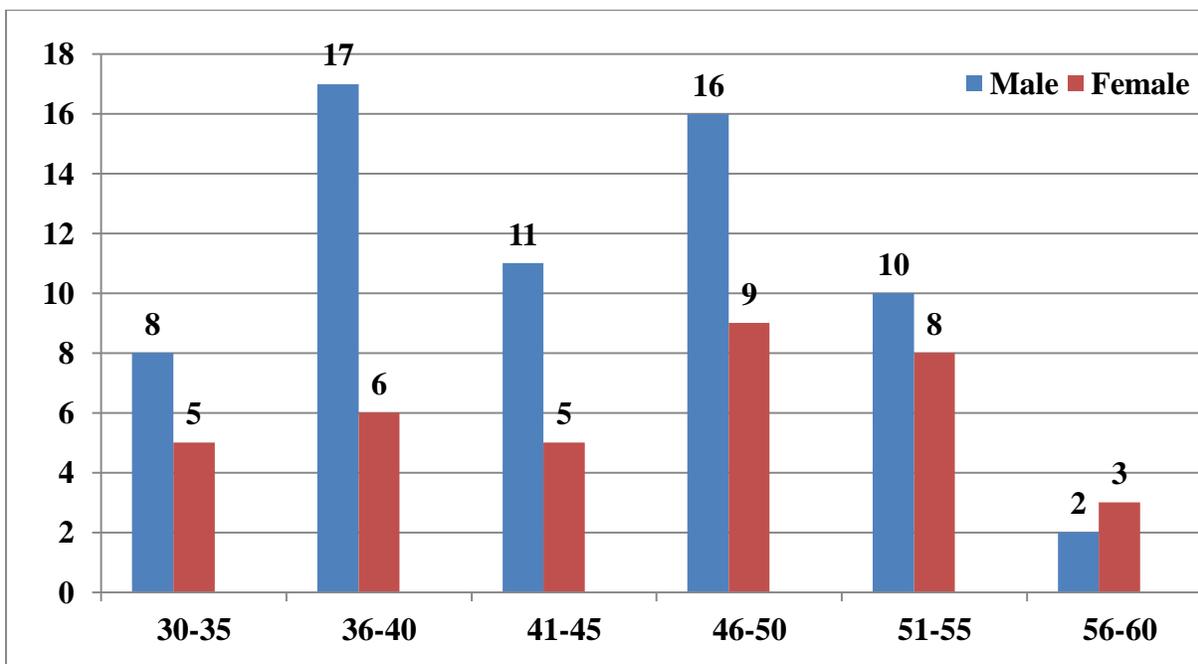
\*p<0.05 significant

**Table 2: FUNDAMENTAL STATISTICAL EXPLANATION WITH LEVEL OF SIGNIFICANCE ASSESSMENT USING PEARSON CHI-SQUARE TEST**

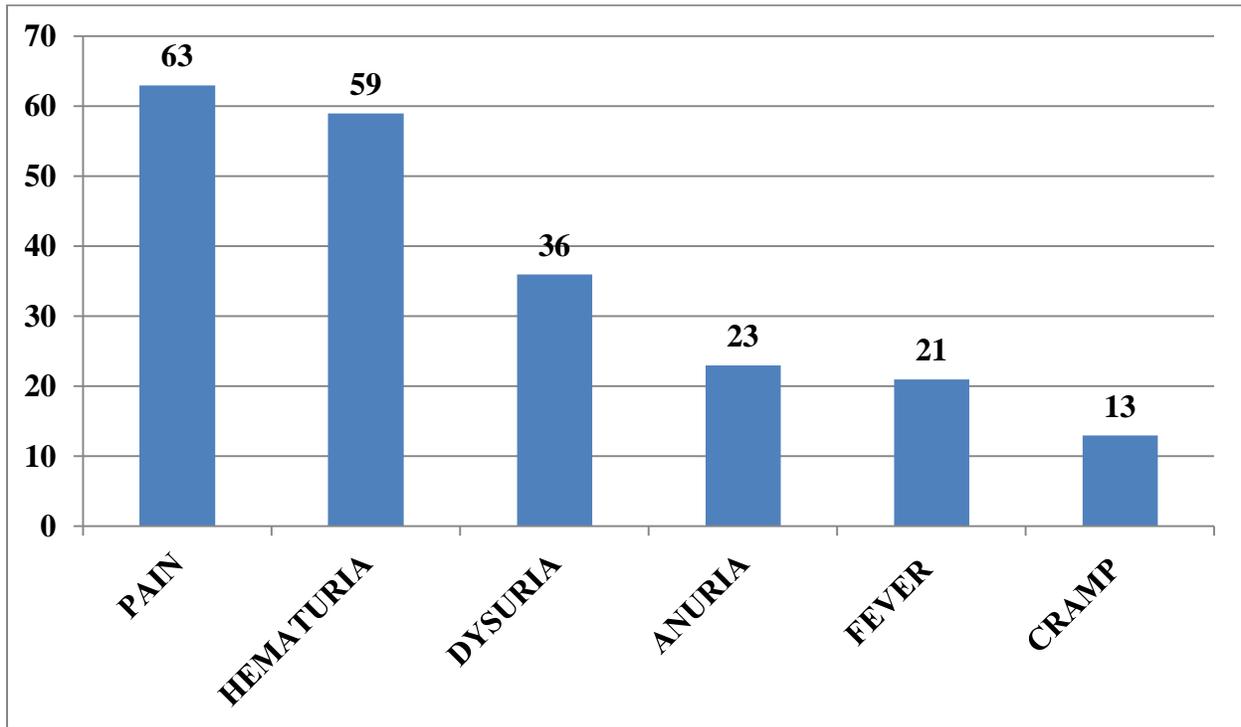
Parameters	Mean	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
PAIN	1.93	1.648	0.823	1.67	1.564	1.0	0.348
HEMATURIA	2.34	1.456	0.950	2.24	2.675	1.0	0.001*
DYSURIA	2.94	0.124	0.648	2.98	2.566	1.0	0.090
ANURIA	3.94	0.724	0.758	2.34	1.646	2.0	0.001*
FEVER	4.45	1.084	0.246	1.89	2.235	2.0	0.000*
CRAMP	3.12	0.346	0.647	1.12	1.897	1.0	0.080

\*p<0.05 significant

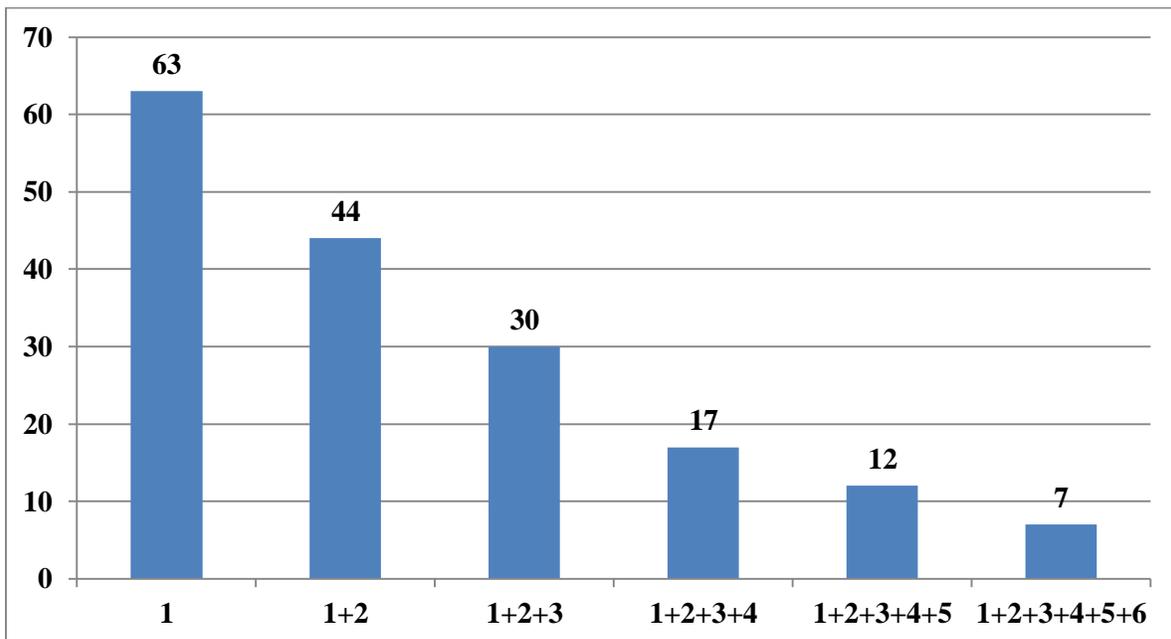
**Graph 1: AGE & GENDER WISE DISTRIBUTION OF PATIENTS**



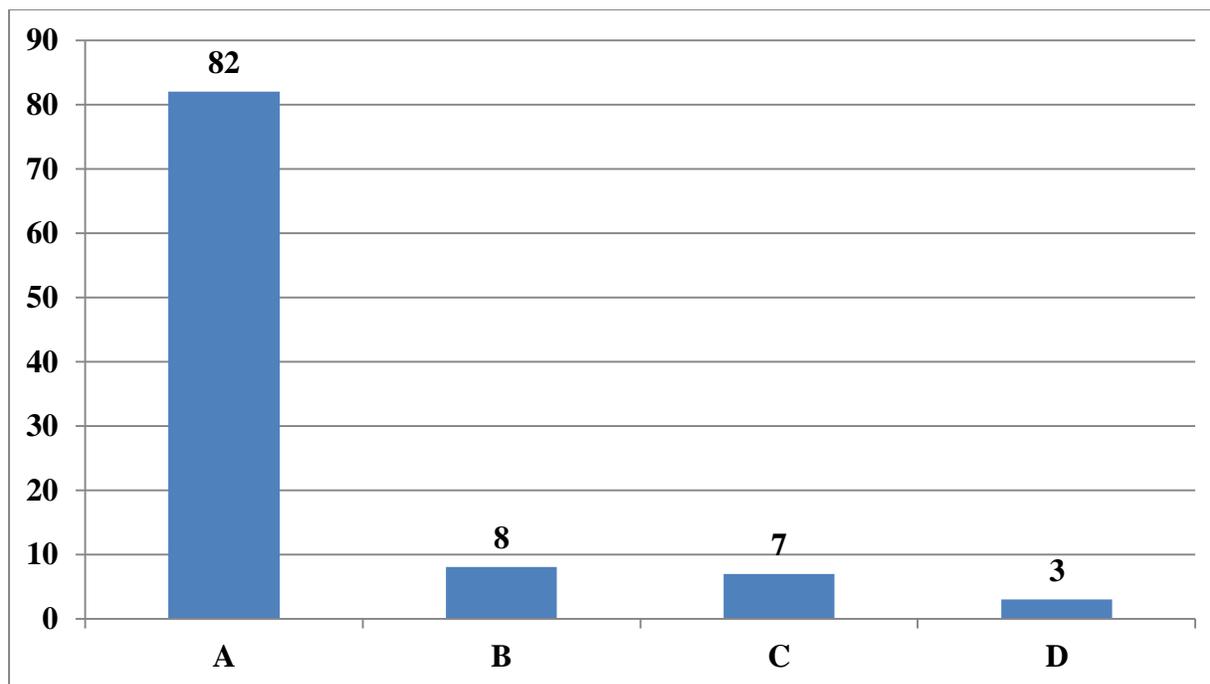
**Graph 2: GRAPHICAL ILLUSTRATION OF INDIVIDUAL COMPLICATIONS ACCORDING TO FREQUENCY OF OCCURRENCE**



**Graph 3: GRAPHICAL ILLUSTRATION OF COMBINATION OF COMPLICATIONS ACCORDING TO FREQUENCY OF OCCURRENCE (PAIN-1, HEMATURIA-2, DYSURIA-3, ANURIA-4, FEVER-5, CRAMP-6)**



**Graph 4: GRAPHICAL ILLUSTRATION OF RENAL CALCULI ACCORDING TO THEIR NATURE: A=Ca OXALATE & Ca PHOSPHATE, B= URIC ACID, C= STRUVITE STONE, D=MIXED**



**DISCUSSION**

Dilemmas associated with renal calculi are usually not single. It is frequently arise as a multi-factorial disease developing as a joint venture of epidemic, bio-chemical and hereditary risk factors. Many of the studies have shown that patients those suffering from renal calculi or kidney stone or nephrolithiasis for the first time have a 50% possibility of reappearance by 10 years.<sup>12</sup>Knoll also explored the similar findings.<sup>13</sup>As a health care professional we must take care of it and try our best to avoid such recurrences. For the same, a detailed medical history and patient’s vital metabolic assessment must be done judiciously. Any detected renal calculi must be comprehensively studied for its number, size, morphology, biochemistry and site of occurrences.<sup>14,15</sup> Romero and associates stated that patients with high risk of nephrolithiasis must be undergone for few basic serological examinations to outline exact etiology of the calculi.<sup>16</sup> These usually include serological calcium, phosphorous, potassium, bicarbonate, blood urea nitrogen, creatinine and uric acid. After secretion stage, urine has numerous salts and minerals in the form of solute. All such clinical conditions (high levels of salt or mineral) make the patients more prone to develop renal calculi. Initially they start as a tiny mass but if left unattended, they may grow up in a larger lump. These lumps are sufficient enough to cause the classical symptoms of renal stone including hematuria.<sup>17</sup> All renal calculi are formed inside kidney and later on they passed down to the ureter, urinary bladder and urethra.

Most of small sized calculi behave like a ghost. Mostly they are undetected and does not cause any discomfort to the patient. Afsar and coworkers have shown the similar inferences.<sup>18</sup> Literature has well evidenced that if the calculi arrived at the urinary bladder, it may be flushed out of body easily with urinary flow. However, in case it jammed in the ureter or bladder, it may obstruct the normal urination. Several pioneer workers including Robertson and associates have shown in their studies that pain is typically the first sign of renal calculi.<sup>19</sup> Hence, our study results were in accordance with the results put forwarded by Robertson and associates. Its nature is very peculiar and concentrates frequently on back (either side). However, reports have also been presented where patients had complained of referred pain also. Renal calculi are of different size, shapes, color and materials. Most common types of renal calculi are calcium based.<sup>20</sup> Therefore, our study results were in accordance with the results drawn by Singh and associates. They are of two types,calcium oxalate and calcium phosphate. Among these, calcium oxalate is the omnipotent variety of renalcalculi. As per the conclusion drawn by Sofia and colleagues, calcium oxalate calculi can be easily identified by the shape of the particular crystalline structures.<sup>21</sup> Calcium oxalate dihydrate crystals are octahedral in shape however; calcium oxalate monohydrate crystals show a discrepancy in shape. Later could be found in the shape of dumbbells, spindles, ovals, or picket fences. Uric acid is a biochemical waste product which is formed

during different metabolic cycles.<sup>22</sup> This acid does not easily dissolve in urine therefore resulting into formation of uric acid stones. As per the advisories of Joseph and colleagues, it is sensible to avoid high consumption of liquid with phosphorus.<sup>23</sup> Most of the studies have recommended drinking minimum two liters or more water per day. Most of the citrus based fruit juices, particularly orange, grapefruit and cranberry, could diminish the risk of renal calculi.<sup>24, 25</sup>

## CONCLUSION

Within the limitations of the study authors concluded few very significant inferences. The authors have concluded that, in the studied patients most common type of renal calculi was calcium oxalate and calcium phosphate. Males were more affected than females. Pain was the most common complication followed by hematuria. Less than 10% patients were having almost all the six studied complications. Our study results must be considered as suggestive for presuming prognosis for similar clinical conditions. However, we expect some other large scale studies to be performed that might further establish certain standard and authentic guidelines in these perspectives.

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