

## ORIGINAL ARTICLE

# Prevalence of Progression Toward Renal Calculi in Patients Suffering from Urinary Tract Infection: A Cross-Sectional Study

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## ABSTRACT

**Objective:** To assess the frequency of renal stones in the patient suffering from urinary tract infection (UTI)

**Study design:** A cross-sectional study

**Place and Duration:** This study was conducted at Northwest General Hospital Peshawar from June 2021 to June 2022

**Methodology:** A total of 115 patients with the symptoms of recurrent urinary tract infection were included in the study. Those patients who had a positive history of upper and lower urinary tract stones, renal tumors, already present renal calculi, and patients with renal failure, were not added to the present study. A specially designed proforma was filled out by all the patients so that the required data could be acquired and analyzed.

**Results:** The mean age of the patients was  $36.1 \pm 15.2$  years ranging from 15 years to 60 years. Urinary tract infection was confirmed in 92 (80%) patients. The most prevalent organism detected on urine culture was E.Coli (29%). Some of the other organisms majorly detected were Proteus (18%), Pseudomonas (8%), Klebsiella (10%), and Staphylococcus aureus (4%). The renal stone disease was found in 18 (19.56%) patients out of which 12 (13.04%) were male and 6 (6.52%) were female. The mean age of the patients presented with renal stones was  $32.65 \pm 15.3$  years. The male-to-female ratio of the patients with renal stones was 1.5:1.

**Conclusion:** A large number of patients with urinary tract infections can develop the renal stone disease. Certain microorganisms are significant in this progression and resulting in renal stones.

**Keywords:** Urinary tract infection, renal stone disease, Microorganisms, E.Coli

## INTRODUCTION

Urinary tract infections (UTIs) are the third most prevalent infections found in human medicine. About 150 million people are affected by these infections on a global level every year [1]. Some of the common symptoms of UTI are fever, abdominal pain, flank pain, renal colic, hematuria, and even sepsis in more extreme cases [2]. Sometimes these infections lead to concretions and a need for insertion of JJ stent can be faced [3]. The stones are formed as a result of urease splitting by certain microorganisms such as Klebsiella, Proteus, Staphylococcus, and Pseudomonas [4]. Patients with higher urinary pH are more likely to have struvite, carapatite, and calcium phosphate stones [5].

Recurrent infections by the urease-splitting microorganisms can also cause chronic kidney disease. Percutaneous Nephrolithotomy is a potent technique for the removal of nephrolithiasis along with lithotripsy [6]. There are several other factors as well that are responsible for increasing the prevalence of renal stones, such as living conditions, age, and ethnicity [7]. Studies show that hydroxyapatite stones are more common in younger individuals and uric acid stones are more prevalent in the older population [8, 9].

The stones which are formed as a result of UTI are not always infectious, they can also be calcium oxalate stones. On the other hand, every type of renal stone has susceptibility to getting infected, however, the infectious stones are always dependent on the Urease splitting bacteria [10].

The current study is planned to assess the frequency of renal stones in the patient suffering from urinary tract infection

## METHODOLOGY

The present study is a cross-sectional study that includes a total of 115 patients. The patients were derived from the outdoor unit as well as the emergency department of the hospital. The sample included both male and female patients. Their mean age was  $36.1 \pm 15.2$  years ranging from 15 years to 60 years. All the patients had presented with the symptoms of urinary tract infection. According to the inclusion and exclusion criteria, the patients with renal failure, already diagnosed urinary tract stones, renal tumors, or previous positive history of nephrolithiasis, were not included in the study. All the patients were made to fill out a proforma which

acquired the general information related to the patients. The proforma also has space for information related to the symptoms of the patient. The literate patients filled their own proforma, whereas those who did not how to write, were aided by junior doctors in the department. A clinical examination of all the patients was performed and then they were sent for investigation.

For urine analysis of the patients, a sample of midstream urine was carefully taken in a sterile container under necessary precautions. The color, pH, sugar, and proteins present in the urine were analyzed. After that, microscopy of the sample was done for detecting pus, epithelial cells, crystals, and erythrocytes. Blood Urine culture was done at  $37^{\circ}\text{C}$  for the detection of microorganisms followed by a sensitivity test.

A plain abdominal film was taken as the first imaging investigation. Ultrasound of the abdomen and pelvis was performed with a special emphasis on the detection of hydronephrosis, size, and site of the radiopaque shadow, structural abnormalities, and parenchymal thickness. Those patients who did not have conclusive results of the ultrasound were referred for Non contrast CT abdomen and pelvis. Furthermore, a complete renal function test including blood urea and serum creatinine was performed along with serum electrolytes. Hyper-uremia and hypocalcemia were noticed by serum uric acid and serum calcium levels. The data was collected and analyzed using IBM SPSS version 26.

## RESULTS

The present study included a sample of 115 patients with symptoms related to urinary tract infections. An analysis of the ages of the patients detected with renal stones has been given in table 1. It can be seen that the stone formation was more common in patients 31 to 50 years old. Moreover, a slight predominance of male patients was noticed over female patients. In the following study population, 12 (13.04%) were male and 6 (6.52%) were female.

The pH of urine was more than 7 in 20% of the patients which was higher compared to the rest of the patients who had acidic pH. The most prevalent organism detected on urine culture was E.coli (29%). Some of the other organisms majorly detected were Proteus (18%), Pseudomonas (8%), Klebsiella (10%), and

Staphylococcus aureus (4%). A total of 27% of the patients also complained of hematuria out of which, 15% had gross hematuria and 12% only had microscopic hematuria. Pyurias were detected in 17% of the patients and crystals of urea, oxalate, calcium, and phosphate were seen in 10%. Urinary tract infection was confirmed in 92 (80%) patients, out of which 18 (19.56%) had renal stones. The distribution of the side in which renal stones were detected, has been mentioned in table 2. It can be seen from the table that left-sided renal stones were more common compared to the right side and bilateral renal stones were very scarce.

Table 1: Age distribution of patients with kidney stones (n=18)

Age (years)	Number of patients	Percentage
15-30	4	22.22
31-40	6	33.33
41-50	7	38.89
51-60	1	5.56

Table 2: Renal stones distribution according to the side

Side	Number of patients	Percentage
Right	6	33.33
Left	10	55.56
Bilateral	2	11.11

## DISCUSSION

The incidence of nephrolithiasis has been increasing in recent years and the prevalence is quite high in Pakistan [11]. The association between UTI and renal stones is difficult and complex to analyze on both clinical and pathophysiological grounds [12].

The study by Ogata et al analyzed the formation of nephrolithiasis in the third and fourth decades of life [13]. The prevalence of renal stones in their study and the present study is similar. According to both studies, renal stones are common in people in the age group of 30-45 years. Okuyama et al conducted a similar study and analyzed the predominance according to gender. They found a male-to-female ratio of upper tract stones at 1.68:1 and lower tract stones at 2.25:1 [14]. These results are comparable to the results of our study in which we found a slight predominance of males with a male-to-female ratio of 1.5:1. However, the study of Rajput et al showed a higher predominance of males with a male-to-female ratio of 4:1 [15].

The urinary pH has a great role in the determination of the type of stone and it is specific for each type. It is alkaline in the case of struvite stones. The urinary pH in 20% of subjects included in the present study was more than 7. It is comparable to the study of Barbey et al in which the high pH of urine was associated with the formation of struvite stones [16]. The prevalence of stones in the patients with UTI was 19.56% as observed in the present study. However, it was slightly lower (10-15%) as per the study of Hochreiter et al and Bichler et al [17, 18].

## CONCLUSION

Persistent UTIs with urea-splitting bacteria and sometimes with non-splitting bacteria can result in the formation of renal stones. Bacterial superimposition is always possible in metabolic stones. Controlling the risk factors can lower the incidence of renal stones.

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