

## Gender differences in the microbiology of urinary tract infections in urolithiasis patients

Mashood Iqbal, Aarsalan Manzoor, Manzoor Hussain

**Received:**  
16th December 2016

**Accepted:**  
23rd June 2017

### Abstract

**Objective:** To study the gender differences in the microbiology of Urinary Tract Infections (UTIs) in urolithiasis patients.

**Methods:** A descriptive comparative study was undertaken at Sindh Institute of Urology and Transplantation (SIUT), Karachi, Pakistan, from July 2014 to October 2014. Data was analyzed using SPSS version 16.0.

**Results:** Renal calculi were more common in females (72.13%) than males (64.8%). Multiple site and bladder stones were more common in males. E.Coli was found to be more common in females (59.01%) in comparison to males (44.8%). Pseudomonas, Proteus, Klebsiella and mixed bacterial growth were more common in males. However, the difference in percentages was not statistically significant. Alarming high rates of resistance were seen to commonly prescribed antibiotics for UTIs.

**Conclusion:** The results from this study imply that the gender differences in the microbiology of UTIs in patients with urolithiasis are not significant.

**Keywords:** infection, urolithiasis, gender, micro-organisms, sensitivity, E.coli, pseudomonas, proteus, klebsiella

### Introduction:

Kidney stone incidence varies in different parts of the world; high incidence areas are Scandinavian countries, Middle East countries, British Isles, Northern Australia, Central Europe, portions of Malayan Peninsula, China, Pakistan, Northern India and North America. In Asia, stone-forming belt has been reported across Sudan, Saudi Arabia, UAE, Islamic Republic of Iran, Pakistan, India, Myanmar, Thailand, Indonesia and Philippines.<sup>1</sup> Pakistan sits in Afro-Asian stone belt where the disease is highly prevalent in the community with the prevalence of 10-15% in the population of Pakistan.<sup>2</sup> The etiology can be multifactorial which includes genetic, environmental and urinary tract infection playing the role in the causation of stone disease.<sup>1</sup>

According to previous studies, renal calculi were more common in males than females with a male to female ratio of 4.5:1.0.<sup>3</sup> A report in 2007 showed a male to female ratio of 2.3:1.0.<sup>2</sup> However, international reports state that gender differences are becoming narrower, with the male to female gap of 1.75:1.54.<sup>4</sup> Urinary tract infection (UTI), dietary factors and life style changes in females are the probable causes of increased number of female patients with stone disease in the recent literature.

Urinary tract infection and renal calculi are strongly co-related with each other. Infection can be the direct cause of stones or can develop in a patient with non-infection related stones.<sup>5</sup> When a normal kidney stone causes obstruction in the urinary tract, the kidney becomes more prone to develop secondary UTI. An infection

**Sindh Institute  
of Urology &  
Transplantation (SIUT),  
Karachi**  
M Iqbal  
A Manzoor  
M Hussain

**Correspondence:**  
Dr. Muhammad Mashood  
Iqbal, House No.199-M,  
Block-2, PECHS, Karachi  
-75400, Pakistan.  
Cell: + 92-316-8937873  
Email: mashood1168@  
gmail.com

Table 1: Patients' demography and types of calculi

Type of Calculi	Patient Demography	
	Male (n=125)	Female (n=61)
	Range (years): 18-90 Mean age (years): 42.78	Range (years): 18-70 Average age (years): 41.56
Renal	64.8%	72.13%
Ureteric	14.4%	16.39%
Bladder	4%	1.64%
Multiple Site	16.8%	9.84%

behind an obstructing stone is often an emergency because the body has difficulty clearing these infections since antibiotics can not reach adequate levels due to decreased blood supply and urine flow. In these cases, urgent drainage of kidney with percutaneous nephrostomy (PCN) or Double J (DJ) stent becomes essential.<sup>5,6</sup>

UTI as an etiological factor is seen in 15% of stone patients.<sup>7</sup> There is also a postulated predisposition of nano-bacteria towards the causation of stones.<sup>8</sup> Studies on these aspects are rare in the literature. However, the role of urease producing bacteria in causing infectious stones is well described. Urease producing organisms include proteus, pseudomonas, klebsiella, staphylococcus and corynebacterium urealyticum.<sup>5</sup>

The gender differences in UTI microbiology amongst patients of urolithiasis are not reported in the literature. According to previous studies on gender differences in ordinary UTI, women have more common E.Coli-based UTI's and men more commonly Proteus-based UTI's.<sup>9,10</sup> However, no studies are found about UTI micro-organisms in stone patients with gender differences. These differences might have diagnostic or therapeutic significance in relation to stone disease. The objective of this study was to study gender differences in microbiology of UTI in stone patients.

#### Materials and Methods:

This study was under-taken at the stone clinic of Sindh Institute of Urology and Transplantation (SIUT). The study took place from July 2014 to October 2014. All male and female patients over 18 years of age with a diagnosis of both UTI and calculi were included; patients with renal failure were excluded, bringing the sample size to a to-

tal of 186 patients. The sampling technique used was purposive convenient. UTI was defined when urine analysis showed pus cells > 10/HPF, positive Nitrite on dipstick and positive Urine culture. Calculus was defined when there was evidence of stone along the urinary tract by ultrasound±CT-pyelogram or X-ray I.V.P or K.U.B.

Data was collected in the stone clinic of SIUT from patient files. The data items included age, sex, residence, calculus type, micro-organisms found in urine culture, and antibiotic sensitivity as variables. Antibiotic sensitivity was done for 15 drugs including sulzone, augmentin, amikacin, gentamicin, imipenem, nitrofurantoin, ciprofloxacin, ampicillin, piperacillin, amoxicillin, cefotaxime, ceftazidime, tobramycin, levofloxacin and fosfomicin.

The patients were identified only using their medical record (M,R) no and patient identity was kept confidential. Patients were explained about the study and they voluntarily consented to be a part of it. The research was conducted according to the principles of the declaration of Helsinki.

Data was analyzed using the SPSS version 16.0 for Windows. Student t- test and Chi-square test were conducted to determine the significance of differences.

#### Results:

The study included 186 stone patients, out of which 125 were males and 61 females. Ages ranged from 18 to 90 years (Table 1). A vast majority of the patients were from the province of Sindh (84.9%).

The most frequent type of stones were renal, i.e., 67.2%, 15% had ureteric, 14.5% had stones in multiple sites. On comparison of site of stones in males and females, we found that renal calculi were more common in females, i.e. 44 out of 61 (72.13%) - whereas in males, renal calculi were seen in 81 out 125 cases (64.8%). However, multiple site and bladder stones were more common in males (Table 1).

Table 2: Sensitivity and Resistance to commonly prescribed antibiotics for UTIs

	Antibiotics	Organisms			
		E. Coli	Pseudomonas	Proteus	Klebsiella
Sensitivity	Amikacin	68.47%	71.43%	80%	52.38%
	Imipenem	75%	71.43%	40%	66.67%
	Sulzone	57.61%	78.61%	60%	52.38%
	Nitrofurantoin	51.09%	92.86%	100%	80%
Resistance	Amoxicillin	94.57%	100%	80%	100%
	Levofloxacin	98.91%	100%	100%	100%
	Ciprofloxacin	77.17%	78.57%	80%	80.95%
	Augmentin	81.52%	100%	60%	57.14%

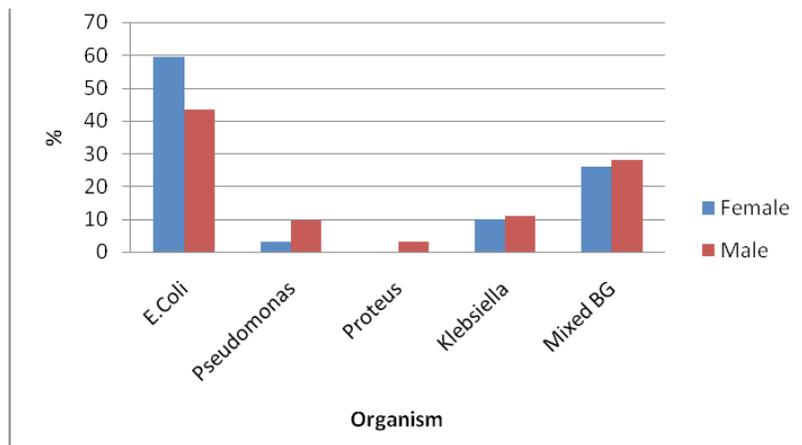


Figure-1: Microbiology of UTIs in the urolithiasis population

Out of the 15 antibiotics for which sensitivity testing was performed, UTI organisms were most sensitive to Amikacin, Imipenem and Sulzone (Table 2). Table 2 further demonstrates the resistance of these organisms to most commonly prescribed drugs for UTI's.

**Discussion:**

Overall, urolithiasis was more common in males (125 males, 61 females), which is in agreement with previous studies in our region. International reports suggest that gender differences in stone population are becoming narrow with a male to female ratio of 1.75:1.54.<sup>4</sup> However, our study showed that renal calculi were more common in females (72.13%) than males (64.8%), correlating with the former international report.<sup>4</sup>

No previous study has been done on microorganisms causing UTI in stone patients with gender differences. This study is the first one conducted on this topic. Analyzing the gender differences in UTI in males and female stone patients, our study showed E.Coli, which was

more common in females (59.01%) in comparison to males (44.8%). Other organisms, including pseudomonas, proteus, klebsiella and mixed bacterial growth, were more common in males (Fig. 1). Our study also showed that stones with urease-producing bacteria were more common in males. However, the difference in percentages between the two genders was not significant. Confirmation of these findings requires further large-scale and multicenter studies on a larger number of patients.

Antibiotic sensitivity was done for 15 drugs. All UTI-based organisms were most sensitive to imipenem, amikacin and sulzone. Our study highlights one highly disturbing finding. Currently, most commonly prescribed drugs for UTI include nitrofurantoin, ciprofloxacin, levofloxacin, amoxicillin and augmentin. We found alarming rates of resistance to these agents (Table 2); pseudomonas, proteus and klebsiella showed nearly 100% resistance to levofloxacin, one commonly prescribed drug for UTI. This implies that newer antibiotics should be developed for UTIs. One possible explanation for this high antibiotic resistance is the injudicious use of antibiotics without medical prescription by physicians and easy availability of drugs at pharmaceutical stores.

**Conclusion:**

Our study concludes that the gender differences in the microbiology of urinary tract infection in patients with uro-lithiasis is not significant. There is a high rate of anti-microbial resistance against commonly prescribed drugs in the stone population of Pakistan. There is a need for further large scale studies to correlate the findings of this study.

Acknowledgements: We are very thankful to Professor S.A.H Rizvi (Director of SIUT) for giving us the permission to conduct this study in this institute. We also thankful to Dr. Zainab Waqar (Professor of Community Medicine - Jinnah Medical and Dental College), Dr. Manzoor Hussain (Professor of Urology - SIUT), Dr. Shahroz Liaquat, Dr. Sadia Faiyaz, Dr. Anita Kanwal and Dr. Sarah Jamal for their extensive support, help and encouragement.

**Conflict of interest:** None

**Funding source:** None

**Role and contribution of authors:**

Dr Mashood Iqbal, conception and designing, collection and analysis of data, primary drafting of the paper.

Dr Arsalan Manzoor, Conception and designing, collection and analysis of data, primary drafting of the paper.

Dr Manzoor Hussain, conception and designing, collection and analysis of data, final drafting, critical review and final approval of the paper.

**References:**

1. Abbagani S., Gundimeda S.D., Varre S., Ponnala D., Mundluru H.P. Kidney Stone Disease: Etiology and Evaluation. *Int J Appl Biol Pharm* 2010; 1(1):175-182.
2. Hussain M., Rizvi S.A.H., Askari H., Sultan G., Lal M., Ali B., et al. Management of Stone Disease: 17 years experience of a stone clinic in a developing country. *J Pak Med Assoc* 2009; 59(12):843-846.
3. Rizvi S.A.H. Calculous Disease-A survey of 400 Patients. *J Pak Med Assoc* 1975:268-273.
4. Pearle M.S., Lotan Y. Urinary Lithiasis: Etiology, Epidemiology, and pathogenesis. In: *Campbell-Walsh Urology*. 10th ed.: Elsevier Saunders, 2012; pp 1257-1260.
5. Brown PD. Management of Urinary Tract Infections Associated with Nephrolithiasis. *Curr Infect Dis Rep* 2010; 12:450-454.
6. Hussain M., Lal M., Ali B., Ahmed S., Zafar N., Naqvi S.A.A. et al. Management of Urinary Calculi Associated with Renal Failure. *J Pak Med Assoc* 1995; 45(8): 205-208.
7. Thomas B., Tolley D. Concurrent urinary tract infection and stone disease: pathogenesis, diagnosis and management; *Nat-Clin Pract Urol*. 2008; 5(12): 668-675.
8. Wood H.M., Shoskes D.A. The role of nanobacteria in urologic disease. *World J Urol* 2006; 24:51-54.
9. Lo D. S., Shieh H.H., Ragazzi S.L., Koch V.H., Martinez M.B., Gilio A.E. Community-acquired urinary tract infection: age and gender-dependent etiology. *J. Bras. Nefrol.* 2013; 35(2):93-98.
10. Magliano E., Grazioli V., DeFlorio L., Leuci A.I., Mattina R., Romano P., et al. Gender and Age Dependent Etiology of Community-Acquired Urinary Tract Infections. *Scientific World Journal* 2012; 349597: 1-6.