Int.J.Curr.Microbiol.App.Sci (2023) *12*(01): 159-170

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 12 Number 1 (2023)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2023.1201.019

Bacteriological Study of Urine and Renal Stones in Patients with Nephrolithiasis Undergoing Percutaneous Nephrolithotomy

S. Shafiyabi*, Mariraj Jeer, H. Pushpalatha, B. Vishalakshi, S. Kalpana, Swathi Sagarika and Shruthi Uppoor

Department of Microbiology, Vijayanagar Institute of Medical Sciences (VIMS), Ballari- 583104, Karnataka, India

**Corresponding author*

Keywords

Nephrolithiasis, Percutaneous nephrolithotomy (PCNL), renal calculi, urine culture, renal stone culture

Article Info

Received:
10 December 2022
Accepted:
31 December 2022
Available Online:
10 January 2023

A B S T R A C T

Nephrolithiasis associated with infected renal calculi act as foci of persistent infection of the urinary tract and development of multidrug resistance representing a significant cause of morbidity and mortality and may not be detected by urine culture alone. This prospective study included 63 patients diagnosed with renal calculi who underwent Percutaneous nephrolithotomy (PCNL) in Tertiary Health Care Centre, to determine the bacteriology and antibiotic sensitivity patterns of pre-operative midstream urine and postoperative stone culture and to study bacterial association between the two cultures and to assess which is a better indicator in establishing urinary tract infection. Out of 63 study subjects, 22 (34.92%) had urine cultures positive and 27 subjects (42.86%) had positive stone cultures. Out of 27 stone culture positive patients, 9 (33.3%) had their urine samples sterile. Out of 22 urine culture positive patients, 4 (18.18%) were negative for stone culture. 13/18 (72.2%) cases revealed concordant growth in both the cultures. Urine culture revealed *Escherichia coli* to be the predominant pathogen whereas postoperative stone analysis revealed *Pseudomonas species* to be predominant. The bacterial isolates were found to be most sensitive to imipenem, piperacillin/tazobactum, nitrofurantoin, cefaperazone and amikacin. Multidrug resistance was found to be present in 41.67% and 51.85% of the bacterial isolates from urine and stone culture respectively. In the present study determined renal stone culture to be more sensitive than urine culture in identifying the etiological agents of urinary tract infection along with their antibiotic susceptibility patterns to serve as guide for appropriate therapy.

Introduction

Urinary tract infections (UTIs) are well known to be associated with Nephrolithiasis or renal stone disease which remains one of the commonest urological disorders worldwide (Naas *et al.,* 2001; Tavichakorntrakool *et al.,* 2012; Asha T. Kore *et al.,* 2013; Ishani, 2015). Incidence of UTI in stone patients varies from 7% to 60% as reported in previous studies by Asha T. Kore *et al.,* (2013) and Songra (2015). Infection stones account for 10–15% of all urinary calculi (Bichler *et al.,* 2002; Flannigan *et al.,* 2014). Despite modern antibiotic therapy and technological advances in stone extraction

procedures, the presence of infection in patients with urinary stones, as well as with infectious stones along with multidrug resistance is still a significant cause of morbidity and mortality (Devraj *et al.,* 2016).

Percutaneous nephrolithotomy (PCNL) is the preferred method of removing renal calculi and upto one-third of PCNL patients experience peri-operative complications like UTI, sepsis and SIRS (Gutierrez *et al.,* 2013; Patrick *et al.,* 2012). Studies have determined that urine culture alone does not always reflect the bacteriology of renal stones and thus stone culture should be the best indicator for identifying the actual microorganisms (Borghi *et al.,* 2012 and Patrick 2012).

Nickel *et al.,* and Griffith *et al.,* have shown the importance of bacteria in the formation of Infective nephrolithiasis. (Golecha *et al.,* 2001; Lojanapiwat, 2015; Asha T. Kore *et al.,* 2013; Bianca *et al.,* 2015; Borghi *et al.,* 2012; McCartney *et al.,* 1985; Mitra *et al.,* 2014 and Songra, 2015). Often the renal stones themselves are the source of infection serving as the nidus for bacteria sometimes resulting in recurrent UTI.

Recent studies conducted in Baghdad (2012); Thailand (2012) and Pakistan (2012) demonstrated prevalence of infected renal stone cases to be 24.4%, 36% and 79% respectively (Tavichakorntrakool *et al.,* 2012). Studies recommend postoperative stone core culture to be more sensitive than preoperative midstream urine culture in establishing the presence of UTI in nephrolithiasis and also serves as a guide in selection of antibiotics to treat infection because of the high prevalence of antimicrobial resistance frequently observed in bacteria isolated from stone formers (Ishani, 2015; Borghi *et al.,* 2012; Tavichakorntrakool *et al.,* 2012).

Although the association between nephrolithiasis and UTIs is generally known and frequently detected, its prevalence, causative microorganisms and their antimicrobial susceptibility patterns remain under-investigated.

This study was thus undertaken in patients who underwent PCNL for management of renal calculi in the department of Urology in VIMS, Ballari to investigate and compare the bacteriology of renal calculi by performing stone core culture in relation to pre-operative urine culture, followed by determination and comparison of antibiotic sensitivity patterns of the bacteria isolated from both the cultures which can serve as a guide to clinicians regarding selection of antibiotics providing an opportunity to institute early targeted therapy and improved patient care.

Objectives of the Study

To evaluate the bacteriological spectrum and antibiotic sensitivity pattern of culture of pre-operative urine samples from patients with renal calculi.

To determine the bacteriological spectrum and antibiotic sensitivity pattern of culture of renal calculi obtained by Percutaneous nephrolithotomy (PCNL).

To evaluate and compare whether pre-operative urine or postoperative stone core culture is more sensitive in determining uroinfections.

Materials and Methods

Study Period

This prospective study was carried out in the Department of Microbiology from July 2016 to December 2016 after receiving patient samples from Urology Department, Vijayanagar Institute of Medical Sciences, Ballari.

Patient selection

Inclusion criteria

The present study population included patients of both sexes and all age groups diagnosed with nephrolithiasis and who underwent surgical intervention for stone extraction by PCNL in the department of Urology.

Exclusion criteria

Patients with urogenital malignancy, other causes of infection and severely immunocompromised patients.

Sample collection and transport

Urine culture (Tille, 2014**;** Colle, 2018; Songra *et al.*, 2015).

Pre-operative mid-stream clean catch urine samples were collected from the study subjects in sterile containers with aseptic precautions prior to starting antibiotic treatment and were transported to the Microbiology lab without delay. All samples received were subjected to microscopic examination and Gram staining and were inoculated onto blood agar and MacConkeys agar and were incubated at 37°C for 24 hours. If no growth observed after 24 hours of incubation, samples were considered sterile. Thereafter, all bacterial isolates obtained in urine culture were identified by standard biochemical tests.

Stone culture (Golecha *et al.*, 2001; Songra *et al.*, 2015; McCartney *et al.*, 1985; Bianca *et al.*, 2015).

Renal calculi obtained during the procedure of percutaneous nephrolithotomy (PCNL) were immediately placed in a sterile container containing sterile saline and transported to the lab. Processing of stones for bacteriological culture was done as described by Ohkawa *et al.*, (Songra *et al.*, 2015). In the laboratory, the renal stones were thoroughly rinsed five times in sterile physiological saline taken in five sterile test tubes. After the last wash, the stones were crushed using sterile mortar and pestle under aseptic conditions and the fragments obtained from the core of the crushed stones were then cultured in 5ml thioglycollate broth and incubated at 37°C for 18-24 hours after which subcultures were made on blood agar and MacConkey's agar and incubated at 37°C for 24 hours for isolation of bacteria followed by identification by standard biochemical tests.

Antibiotic susceptibility testing

All bacterial isolates obtained from both urine and stone samples were subjected to antimicrobial susceptibility testing by Kirby Bauer disc diffusion method on Mueller- Hinton agar and incubated at 37°C for 24 hours and the interpretation of the results done according to the guidelines of Clinical and Laboratory Standards Institute (CLSI, 2015).

The following panel of antibiotics was used for sensitivity testing:

Gram positive isolates

Ampicillin, Amoxicillin/clavulanic acid, Ceftriaxone, Amikacin, Co-trimoxazole, Ciprofloxacin, Gentamycin, Nitrofurantoin, Norfloxacin, Cefaperazone, Doxycycline, Erythromycin, Tobramycin, Vancomycin and Clindamycin.

Gram negative isolates

Ampicillin, Amoxicillin/clavulanic acid, Ceftriaxone, Amikacin, sulfamethoxazole/ trimethoprim, Ciprofloxacin, Gentamycin, Nitrofurantoin, Nalidixic acid, Norfloxacin, Cefoperezone, Doxycycline, Imipenem and piperacillin/tazobactam.

Ethical Clearance

Ethical Clearance to conduct the study was obtained from Ethical Clearance Committee of VIMS, Ballari.

Statistical analysis

Statistical analysis of the data was done using the Statistical Package for the Social Sciences version 20 software. Fisher's exact test and Chi-square tests were performed to determine associations between the two groups and to evaluate significance. *P* value of <0.05 was considered significant. The sensitivity, specificity, positive and negative predictive values

of Midstream Urine culture and stone culture were calculated and correlated and significance determined.

Results and Discussion

The study population comprised of 63 patients including 47 (74.6%) males and 16 (25.4%) females who underwent PCNL for nephrolithiasis during the study period. Their mean age was 36.90 +/- 13.06 years.The distribution of patients according to age group is shown in Figure 1.

In the present study, the incidence of renal stones was found to be highest in the age group of 21-30 years (27%) followed by 31-40 years (19%) and was more commonly seen in males (74.6%). The incidence of infected renal stones in males was 70.37% (n=19) and in case of females it was 33.33% (n=8).

22/63 patients (34.9%) had their pre-operative urine cultures positive and the remaining 41 urine samples (65.1%) were found to be sterile. Two urine samples showed mixed growth. Therefore, the total number of urinary bacterial isolates obtained was 24. The samples that yielded contaminants were not included in the study.

Postoperative stone core culture was found to be positive in 27/63 patients (42.9%) and negative in 36 patients (57.1%). Out of the 27 stone culture positive patients, only 18 (66.7%) had their pre-operative urocultures positive. Thus, 18 patients had both their stone and urine cultures positive and 9 (33.3%) patients with infected renal stones had their urine samples sterile. Out of the 63 cases (100%) who underwent PCNL in the host institution for management of renal calculi, the following results were obtained after urine and stone cultures depicted in Table 1.

22 (34.92%) positive urocultures and 41 (65.08%) negatives.

27 (42.86%) infected stones and 36 (57.14%) sterile ones.

18 (28.57%) cases with both positive stone and urocultures.

09 (14.29%) cases with infected stones and sterile urine samples.

04 (6.35%) cases with positive urocultures and sterile stones.

32 (50.79%) cases wherein both stones and urine cultures were sterile.

31 (49.21%) cases had either positive urine and /or stone cultures.

The present study revealed that the most prevalent culture positive sample was renal calculi which was significantly higher than that of midstream urine samples (p=<0.001). The association of pre-operative urine culture and post-operative stone core culture was found to be statistically significant with stone core culture being a better indicator in establishing urinary tract infection and served as a better guide in selection of antibiotics for therapy.

Table 2. lists the Sensitivity, Specificity, Positive predictive value, Negative predictive value and Accuracy of urine culture with respect to stone core culture. Considering stone core culture as gold standard, sensitivity and specificity of urine culture was found to be 66.67% and 88.89% respectively with PPV of 81.82% and NPV of 78.05%. These results suggest that stone core culture had better sensitivity than preoperative urine culture for determining infection of urinary tract.

As shown in Figure 2, out of the 24 (100%) bacterial isolates obtained from urine culture,7/24 (29.2%) isolates were Gram positive cocci and 17/24 (70.8%) isolates were Gram negative bacilli. 2 urine samples yielded polymicrobial growth. Escherichia coli (20.8%) was found to be predominant followed by urease producers. On the other hand, out of 27 bacterial isolates obtained from stone culture, 6/27 (22.2%) were Gram positive cocci and 21/27

(77.8%) isolates were Gram negative bacilli as shown in Figure 3. The most common organism isolated from renal stone culture was *Pseudomonas aeruginosa* (26%) followed by Proteus species (18.5%) and *Staphylococcus aureus* (14.8%). Urease producing bacteria isolated from preoperative urine and renal stones were 58.3% and 81.5%respectively. Out of 18 patients who had both their urine and stone cultures positive, 13 (72.2%) revealed concordant growth and 5 (27.8%) yielded different growth from both the samples (Table 3).

In the present study revealed that there were differences between bacterial isolates obtained from urine and stone cultures with regard to antibiotic susceptibility patterns (Table 4 and 5). The renal calculi isolates were found to be more resistant than urinary isolates to many of the commonly used antibiotics tested. Two *S. aureus* isolates one from MSU and one from stone culture were found to be MRSA. Multidrug resistance was found to be present in 41.67% of the bacterial isolates from urine and 51.85% of bacterial isolates from stone culture.

Nephrolithiasis is a frequently occurring urological disorder worldwide associated commonly with bacterial infection, representing a significant cause of morbidity and mortality (Tavichakorntrakool *et al.*, 2012; Ishani, 2015; Borghi *et al.*, 2012; Golecha *et al.*, 2001). The incidence and prevalence of renal calculi have increased globally across all ages, sex, and race, probably due to change in environment, dietary habits and global warming (Shoshany *et al.*, 2015; Ishani, 2015). The occurrence of infected stones varies between 3% and 34% (Ishani, 2015; Golecha, *et al.*, 2001). In industrial countries, approximately 10–15% of urinary stones are infection stones (Bichler, 2002). In the present study the prevalence of UTI associated with infected stones was 49.21% which was higher than studies conducted in Thailand (36%) and Baghdad (24.4%) but lesser than that of Bianca *et al.*, (59%) and Bralett *et al.*, (53%). (Tavichakorntrakool *et al.*, 2012; Ishani, 2015). In the present study, infectious renal stones were found to be more in males (70.37%) than females (33.33%) which is similar to the study conducted in NEIGRIHMS (Ishani, 2015). On the contrary, studies conducted by Golechha *et al.*, (2001); Bianca *et al.*, (2015); Songra *et al.*, (2015) and Naas *et al.*, (2001) showed that infected renal stones were more among females probably due to increased incidence of recurrent UTI. The incidence of infected renal stones in the present study, was highest in patients in their second and third decade of life (46%) which was in concordance with studies conducted in Shillong and Arabia (Naas *et al.*, 2001) whereas Dr. Ishani found the same in the age group above 50 years (Ishani, 2015).

Presence of infection was traditionally diagnosed with midstream urine (MSU) Culture and Sensitivity but studies have reported that preoperative voided urine cultures from patients with renal calculi may not be reflective of the bacterial environment within the stone (Patrick, 2012). Moreover, several authors have reported a poor correlation between infection in the stone and urine specimens. In one series, stone culture was positive in 77% of the patients whereas a simultaneous bladder urine sample was positive in only 12.5% of the patients (Devraj *et al.*, 2016).

Devraj *et al.*, (2016) reported that urine culture was positive in 11.2% whereas stone culture was positive in 35.2%. The present study revealed that MSU culture was positive only in 34.92% whereas stone culture was positive in 42.86%. A recent study from Pakistan even showed a prevalence of infection around 79% in stone formers, isolating various species of Gram-negative bacteria from the urine samples (Borghi *et al.*, 2012). A comparison of different studies with regard to urine and stone cultures has been shown in Table.6.

Table.1 Urine Culture Versus Stone Culture

Name of specimen	Urine samples culture positive	Urine samples culture negative	Total	Significance
Stone culture positive	18 (28.57%)	09 (14.29%)	27 (42.86%)	< 0.001*
Stone culture negative	04 (6.35%)	32 (50.79%)	36 (57.14%)	
Total	22 (34.92%)	41 (65.08%)	63	

* Fisher's exact test and Chi-square test

Table.2 Sensitivity, specificity, positive and negative predictive value parameters of Urine culture with respect to stone core culture

Indicators	Value	95% CI
Sensitivity	66.67%	46.04% - 83.48%
Specificity	88.89%	73.94%-96.89%
Positive predictive value (PPV)	81.82%	63.24%-92.1%
Negative predictive value (NPV)	78.05%	67.32%-85.99%
Accuracy	79.37%	67.30% - 88.53%

Table.3 Urine Culture Versus Stone Culture

Culture results	Number	Percentage
Same organism in urine and stone cultures	13	72.2%
Different organism in urine and stone cultures	05	27.8%
Total	**18**	**100**

Table.4 Antibiotic Susceptibility of Gram-Positive Bacteria Isolated From Urine And Renal Stone Samples

Antibiotics	Urine culture isolates (n=7)		Renal stone culture isolates (n=6)	
	Percentage sensitive	Percentage resistant	Percentage sensitive	Percentage resistant
Ampicillin (10mcg)	14.3%	85.7%	00	100%
Amoxicillin/ clavulanic acid(20/10 mcg)	57.1%	42.9%	33.3%	66.7%
Ceftriaxone (30mcg)	42.9%	57.1%	50%	50%
Amikacin (30mcg)	42.9%	57.1%	66.7%	33.3%
Cotrimoxazole (25mcg)	42.9%	57.1%	16.7%	83.3%
Ciprofloxacin (5mcg)	57.1%	42.9%	33.3%	66.7%
Gentamycin (10mcg)	28.6%	71.4%	16.7%	83.3%
Nitrofurantoin (300mcg)	71.4%	28.6%	66.7%	33.3%
Norfloxacin (10mcg)	42.9%	57.1%	33.3%	66.7%
Cefaperazone (75mcg)	85.7%	14.3%	83.3%	16.7%
Doxycycline (10mcg)	57.1%	42.9%	50%	50%
Erythromycin (10mcg)	57.1%	42.9%	33.3%	66.7%
Tobramycin (10mcg)	85.7%	14.3%	100%	00
Vancomycin (30 mcg)	100%	00	100%	00
Clindamycin (2 mcg)	57.1%	42.9%	66.7%	33.3%

Table.5 Antibiotic Susceptibility of Gram-Negative Bacteria Isolated From Urine And Stone Samples

Antibiotics	Urine culture isolates (n=17)		Renal stone culture isolates (n=21)	
	Percentage sensitive	Percentage resistant	Percentage sensitive	Percentage resistant
Ampicillin (10mcg)	00	100%	00	100%
Amoxicillin/ clavulanic acid (20/10 mcg)	41.2%	58.8%	37.1%	62.9%
Ceftriaxone (30mcg)	35.3%	64.7%	33.3%	66.7%
Amikacin (30mcg)	70.6%	29.4%	66.7%	33.3%
Cotrimoxazole (25mcg)	41.2%	58.8%	33.3%	66.7%
Ciprofloxacin (5mcg)	35.3%	64.7%	29.6%	70.4%
Gentamycin (10mcg)	41.2%	58.8%	37.1%	62.9%
Nitrofurantoin (300mcg)	82.4%	17.6%	74.1%	25.9%
Nalidixic acid (30mcg)	29.5%	70.5%	29.6%	70.4%
Norfloxacin (10mcg)	47.1%	52.9%	26%	74%
Cefaperazone (75mcg)	82.4%	17.6%	77.8%	22.2%
Doxycycline (10mcg)	58.8%	41.2%	55.6%	44.4%
Imipenem (10mcg)	94.1%	05.9%	100%	00
Piperacillin/Tazobactam(100/10mcg)	88.3%	11.7%	96.3%	03.7%

Table.6 Urine Culture Versus Stone Culture Positivity

Name of the study	Total patients(n)	Urine culture positivity	Stone culture positivity	Both Samples positive	Concordant bacterial growth
Present study	**63**	**34.92%**	**42.86%**	**28.57%**	**72.2%**
Asha et al (2013)	221	55.2%	28.57%	19.04%	14.28%
Devraj R et al (2016)	83	10.8%	30.1%	-	-
Bhargava et al (2015)	83	10.8%	30.1%	-	16%
Mariappan et al (Devraj et al 2016)	54	11.2	35.2%	-	-
Dr Ishani (2015)	95	52%	60%	38.95%	37.5%
Naas et al (2001)	52	29	19 (37%)	-	-
SongraM.C. et al (2015)	100	45%	65%	30%	17.77%
Eshwara et al (Indira Malik et al 2016)	11	-	73%	-	-
Bianca T. et al (2015)	50	58%	56%	20	60%
Tavichakorntrakool R.et al. (2012)	100	-	36 %	20 %	95%
Golechha S(2001)	100	38%	31%	46%	48.38%
McCartney et al (1985)	24	05	10	-	-

Fig.1 Age-Group Wise Distribution of Patients

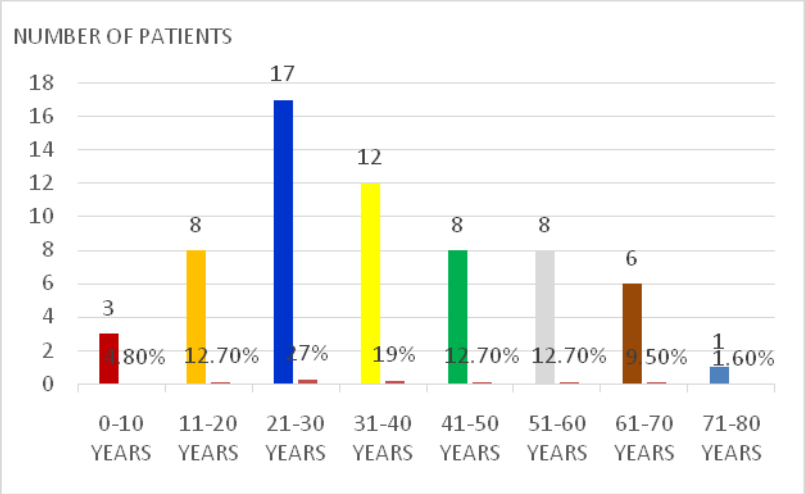


Fig.2 Bacteria Isolated From Pre-Operative Urine Culture

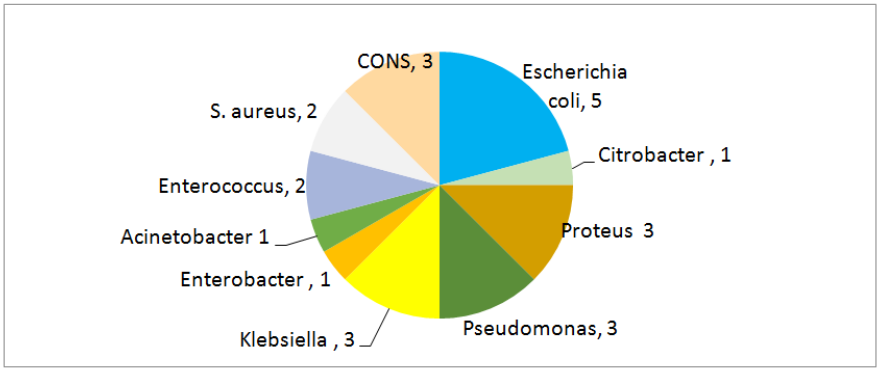
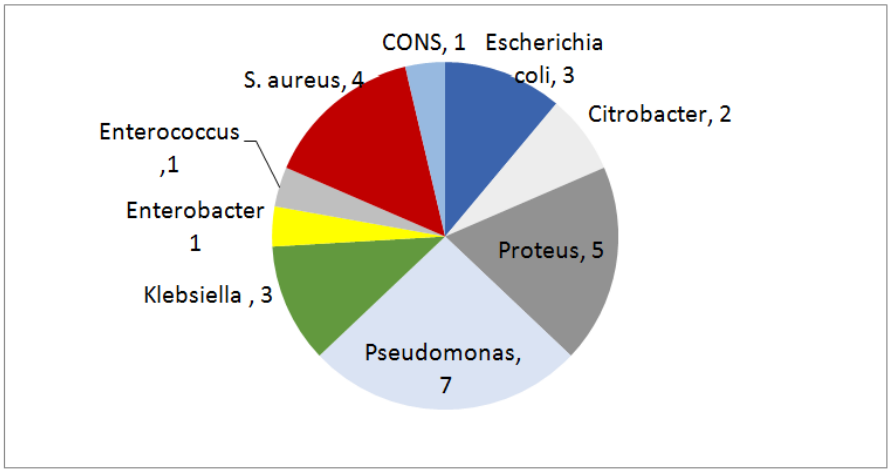


Fig.3 Bacteria Isolated From Post-Operative Renal Stone Culture



Infection stones make up approximately 15% of urinary stone disease (Bichler, 2002). A definite relationship is seen between the presence of bacteria and activity of bacterial urease by hydrolysing urea into ammonia and carbon dioxide resulting in an alkaline pH and thus facilitating formation of calculi leading to persistent infections (Golecha, 2001; Griffith *et al.,* 1982; Asha T. Kore *et al.,* 2013; Ishani, 2015; Naas *et al.,* 2001; Songra *et al.,* 2015; Motamedinia *et al.,* 2014; Robert *et al.,* 1985; Bianca *et al.,* 2015; Bichler *et al.,* 2002). Non urease producing bacteria too can cause inflammation and injury to renal cells potentiating stone formation (Motamedinia *et al.,* 2014). Many studies have shown *Escherichia coli* though non urease producer to be the predominant isolate in infected stones. (Golechha, 2001; Tavichakorntrakool *et al.,* 2012; Songra *et al.,* 2015; Bhargava *et al.,* 2015; Devraj *et al.,* 2016). In the present study showed a high prevalence of urea splitting bacteria in both stone (81.5%) and urine (58.3%) cultures which was higher than that of the study by Naas *et al.,* (2001). In a study by Tavichakorntrakool *et al.,* urea-splitting bacteria were not the major microorganisms, whereas a study in Baghdad reported 74% of the isolated microorganisms were urea-splitters. (Tavichakorntrakool *et al.,* 2012). These contradictory results might be due to geographical differences and different pathogenic mechanisms of nephrolithiasis and its association with UTIs (Tavichakorntrakool *et al.,* 2012). Studies have shown *Escherichia coli* and *Pseudomonas aeruginosa* to be the predominant organisms in urine and stone cultures respectively similar to the present study. (McCartney *et al.,* 1985; Asha *et al.,* 2013; Ishani, 2015; Songra *et al.,* 2015; Bianca *et al.,* 2015).

Studies have shown that culture of voided urine does not always reflect the bacteriology of renal stones, as the bacteria within the renal calculi may differ significantly from that present in voided urine, thereby potentially evading the initial antibiotic coverage resulting in increased risk of urosepsis four fold with drug resistant organisms (Golecha *et al.,* 2001; Motamedinia *et al.,* 2014; Songra *et al.,* 2015; Ranasingh *et al.,* 2015). Studies have concluded stone cultures to be a better predictor of sepsis than voided urine cultures (Motamedinia *et al.,* 2014; Indira Malik *et al.,* 2016; Gutierrez *et al.,* 2013). Preop urine culture failed to predict infection within stone in 60% of patients by McCartney *et al.,* (1985). Motamedinia *et al.,* determined 35% of patients undergoing PCNL had positive stone cultures (2014). Mariappan and Loong reported that 25/75 patients had positive stone cultures whereas Hugosson and colleagues reported the same in 30% of patients (Indira malik *et al.,* 2016). Thus, a vicious cycle starts, infection bringing about stone formation and stone formation causing infection which when left untreated, these events can result in loss of kidney function (Songra *et al.,* 2015; Ishani, 2015; Shoshany, 2015; Bianca *et al.,* 2015). Another very important issue emerging from the study by Tavichakorntrakool *et al.,* is the high prevalence of antimicrobial resistance (70%) from stone formers with UTIs. (Tavichakorntrakool *et al.,* 2012; Ishani, 2015; Indira malik *et al.,* 2016; Zanetti *et al.,* 2008). In the present study revealed that renal calculi isolates (51.85%) were more resistant than urinary isolates (41.67%) to many of the antimicrobial agents tested which is consistent with the study conducted by Dr. Ishani (58%) (2015) and Songra *et al.,* (40%) (2015). This can be explained by the presence of bacteria below the surface of the stone which are not easily accessible to antibiotics. Thus, culture and antibiotic sensitivity of stone isolates is more useful for adequate treatment of the urinary tract infection when compared to urine culture alone providing an opportunity to institute earlier targeted therapy.

In the present study revealed renal stone culture to be positive in a considerable percentage of study population compared to urine culture which failed to detect infection in 51.85% of patients with renal calculi.

Escherichia coli was found to be predominant among preoperative midstream urinary isolates

and Pseudomonas was commonest among postoperative stone core culture isolates. In the present study revealed that stone core culture isolates were found to be more multidrug resistant than urine isolates.

While correlating the results of concurrent bacteriological analysis of urine and stone culture, it is evident that 72.2% cases revealed concordant growth with same isolates in both the cultures and 27.8% yielded different growth.

Therefore, it is essential that stone cultures be performed in patients undergoing surgery for urolithiasis by PCNL followed by antibiotic susceptibility testing in order to ensure adequate and appropriate antibiotic therapy as midstream urine cultures do not always reflect the causative organism.

In the Present study concluded postoperative stone core culture to be better indicator of UTI and served to be the best guide for antibiotic therapy than mere preoperative midstream urine culture.

Thus, this study highlights the importance of performing postoperative stone cultures routinely in addition to MSU cultures and determine their association which will be of great benefit to patient management.

Conflict of interest

Authors declare no conflict of interest.

Acknowledgement

The authors wish to thank all the staff of Department of Urology, VIMS, Ballari for their immense support and cooperation throughout the study. We also convey our special thanks to all the staff and lab technicians of Department of Microbiology, VIMS, Ballari for their constant support throughout the study period.

References

Asha T. Kore, Singh G. and S G Pawar. (2013). Bacteriological Profile of Urine in Patients with Urinary Calculi, Indian Journal of Applied Research; Vol 3: (8). https://doi.org/10.15373/2249555X/AUG2013/191

Bhargava Vardhana Reddy K, Malleswari R., Sridevi S. (2015). Comparative Study of Culture and Sensitivity Patterns of Pre-Operative Mid-Stream Urine with Renal Pelvic Urine and Stone to Predict Urosepsis Following Percutaneous Nephrolithotomy: A Prospective Clinical Study Journal of Evidence Based Medicine and Healthcare; Volume 2 (45); November, 2015: 8178-8182.

Bianca T, Felicia T, Boja R, Oşan V., Teodora C., Szavuj J., Man A. (2015). Bacteriological Study of Urinary Stones. Acta Medica. *J Surg, 11*: *389-31, 2015*.

Bichler K.-H., Eipper E., Naber K., Braun V., Zimmermann R., Lahme S. (2002) Urinary infection stones. International Journal of Antimicrobial Agents, 19: 488-498. https://doi.org/10.1016/s0924-8579(02)00088-2

Borghi L, Nouvenne A and Meschi T. (2012). Nephrolithiasis and Urinary Tract Infections: 'The Chicken or The Egg' Dilemma? Nephrol Dial Transplant 27: 3982–3985.

Clinical and Laboratory Standards Institute. (CLSI). (2015). M100-S25. Jan 2015:17-19.

Colle J. G., Fraser A. G., Marmion B. P., Simmons A. (2018). Mackie and Mc Cartney Practical Medical Microbiology. 14th ed., 84-90.

Devraj R, Tanneru K, Reddy B, Amancherla H, Chilumala R. (2016). Renal Stone Culture and Sensitivity Is A Better Predictor Of Potential Urosepsis Than Pelvic Or Midstream Urine Culture And Sensitivity. Journal of Dr. NTR University of Health Sciences;5(4).

Flannigan R, Choy W. H., Chew B. and Lange D. (2014). Renal struvite stones—pathogenesis, microbiology, and management strategies. Nature Reviews Urology, 11: 333–341.

Golecha S, Solanki A. (2001). Bacteriology and Chemical Composition of Renal Calculi Accompanying Urinary Tract Infection. Indian J Urol, 17:111-7.

Griffith D. P *et al.*, (1982). Infection-Induced Renal Calculi Kidney International, Vol. 21: 422-430. https://doi.org/10.1038/ki.1982.40

Gutierrez J *et al.*, (2013). Urinary Tract Infections and Post-Operative Fever in Percutaneous Nephrolithotomy. World J Urol, 31:1135–1140. : https://doi.org/10.1007/s00345-012-0836-y

Indira Malik and Rachna Wadhwa (2016**)** Percutaneous Nephrolithotomy: Current Clinical Opinions and Anesthesiologists Perspective. Anesthesiology Research and Practice Volume 2016, Article ID 9036872, 7 pages http://dx.doi.org/10.1155/2016/9036872.

Ishani Bora. (2015) Bacteriological Profile of Renal Stones Among Patients Attending Neigrihms. International Journal of Current Research, 7(06):16898-16901.

Lojanapiwat B. (2015). Infective complication following percutaneous nephrolithotomy. Urological Science (Urols.) 04: 07.

McCartney, A. C., Clark, J. & Lewi H. J. E. Bacteriological Study Of Renal Calculi. (1985) Bacteriological Study Of Renal Stones Eur. J, Clin. Microbiol. 4: 553. https://doi.org/10.1007/BF02013393

Mitra R. De Cógáin, John C. Lieske, Terri J. Vrtiska, Pritish K. Tosh, and Amy E. Krambeck. (2014). Secondarily Infected Non-Struvite Urolithiasis: A Prospective Evaluation Urology. December; 84(6): 1295–1300.

Motamedinia P, Korets R, Badalato G., Gupta M. (2014). Perioperative Cultures and The Role of Antibiotics During Stonesurgery. TranslAndrolUrol; 3(3):297-301. https://doi.org/10.3978/j.issn.2223-4683.2014.07.01

Naas T, S Al Agili A. O Bashir. (2001) Urinary Calculi: Bacteriological A Chemical Association. Eastern Mediterranean Health Journal Jour, Vol 7: (4-5).

Patrick W. Mufarrij, Jessica N. Lange, Dean G. Assimos, Majid Mirzazadeh, Ross P. Holmes. (2012). Multibacterial Growth from A Surgical Renal Stone Culture: A Case Report and Literature Review. Rev Urol.14(3/4):108-114.

Robert J. C. Mclean, J. Curtis Nickel, Victor C. Noakes, and J. William Costertonl. (1985). An In Vitro Ultrastructural Study of Infectious Kidney Stone Genesis. Infection and Immunity. Vol 49(3) P. 805-811.

Shoshany O, Margel D. (2015) Percutaneous Nephrolithotomy for Infection Stones: What Is the Risk for Postoperative Sepsis? A Retrospective Cohort Study. Urolithiasis. Volume 43 (3): 237–242.

Songra M. C., Damor M, Namdev R. K., Patbamniya N. K, Nawalakhe P, Jain R. (2015). A Study on Positive Stone Culture and Its Association with Rate of Sepsis After Urological Procedures Int Surg J. May; 2 (2):239-246. https://doi.org/10.5455/2349-2902.isj20150522

Tavichakorntrakool R. *et al.*, (2012). Extensive characterizations of bacteria isolated from catheterized urine and stone matrices in patients with nephrolithiasis, Nephrol Dial Transplant, 0: 1–6. https://doi.org/10.1093/ndt/gfs057

Tille P M. (2014). Bailey and Scott's Diagnostic Microbiology. 13th ed., Mosby Elsevier; 919-930.

Zanetti G, Paparella S, Trinchieri A, Prezioso D, Rocco F, Naber K G. (2008). Infections and urolithiasis: current clinical evidence in prophylaxis and antibiotic therapy. Arch Ital Urol Androl., 2008; 80 (1): 5-12. https://doi.org/10.1007/s11934-022-01103-y

How to cite this article:

Shafiyabi, S., Mariraj Jeer, H. Pushpalatha, B. Vishalakshi, S. Kalpana, Swathi Sagarika and Shruthi Uppoor. 2023. Bacteriological Study of Urine and Renal Stones in Patients with Nephrolithiasis Undergoing Percutaneous Nephrolithotomy. *Int.J.Curr.Microbiol.App.Sci.* 12(01): 159-170.

doi: https://doi.org/10.20546/ijcmas.2023.1201.019