ORIGINAL RESEARCH

A comparison of pre-operative bladder urine culture with intra-operative Renal stone culture

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Received: 15 January, 2023 Accepted: 20 February, 2023

ABSTRACT
Aim: A comparison of pre-operative bladder urine culture with intra-operative Renal stone culture.
Material and methods: This was a prospective observational study was conducted at Department of UroSurgery, in Sri Aurobindo Medical College & Postgraduate Institute, Indore (M.P.). A total of 100 cases were taken in the study. All patients with negative pre-operative urine culture were given a single shot of ceftazidime 1g IV 2 h before the urological procedure and patients who had a positive urine culture were treated with antibiotics for 3 to 5 days before surgery based on sensitivity. Stone fragments were aseptically collected during the procedure and were sent for culture and antibiotic sensitivity.
Results: Of the 100 cases of urolithiasis enrolled in this study, 62% were male and 38% were female (M/F ratio was 1.63:1) with mean age of 47.25±4.69 years. Among the study population, 27% had a positive pre-operative urine culture, whereas 55% patients were positive for stone culture (Table 2). Most common bacteria isolated in urine culture were *E. Coli* (33.33%), followed by Pseudomonas (25.93%), Enterococcus (11.11%), Enterobacter (14.81%), coagulase- negative Staphylococcus aureus and Klebsiella 7.41% each). The most common bacteria isolated in stone culture was Pseudomonas followed by Enterobacter, *E. coli* and others (Table 3).
Conclusions: Urine culture has a low predictive value and accuracy when it comes to determining the bacteriology of stone; as a result, it cannot be utilised as a surrogate marker for this condition. When it comes to cases of renal stones, this is where its clinical significance is at its highest.
Keywords: Urine culture, stone, *E. Coli*, urolithiasis

INTRODUCTION

The most common bacterial infection diagnosed in the wider population and in healthcare facilities is a urinary tract infection (UTI). According to estimates, 11% of the population has suffered from a UTI at a certain point in their lives, and nearly half of adult women have experienced one[1,2]. Although the majority of UTI's clinical symptoms are modest, the condition has the potential to develop in several high-risk groups, such as young children, pregnant women, and the elderly[3]. To enhance the clinical results of UTI patients, early detection and empirical antibiotic treatment are therefore crucial[4].

UTIs and urosepsis continue to be among the most frequent causes for pre- and post-operative urological consultation, increasing the cost of medical care, morbidity, and mortality. For many years, it has been well recognised that infections are frequently accompanied by urinary calculi [5]. A systemic inflammatory response syndrome (SIRS) may be brought on by this link between urinary calculi and infection before, during, or after receiving medicinal or surgical treatment[6].

Additionally, it is uncommon for patients to develop post-operative sepsis after stone manipulation or fragmentation, possibly as a result of bacteria being released into the blood stream despite it having a sterile pre-operative urine culture[7,8].

If not treated quickly and aggressively, this condition could even progress and result in multiple organ failure and even death. Therefore, also with full pre-operative antibiotic therapy and a negative urine culture, urosepsis in the post-operative period may lead to death. Thus, the bacterial flora of the stone could be used as an early indicator of post-operative urosepsis treatment or prevention. In endourologic procedures, stone culture is not a common practice, and the management of sepsis and post-operative infections has relied heavily on pre-operative urine cultures. The goal of this research was to evaluate whether there was a correlation between pre-operative urine culture and intra-operative renal stone culture acquired during PCNL procedure, in order to determine whether urine culture could be utilized as a sign marker for the bacterial flora found in stone.

MATERIAL AND METHODS

This was a prospective observational studyentitled **"A comparison of pre-operative bladder urine culture with intra-operative Renal stone culture"** was conducted at Department of UroSurgery, in Sri Aurobindo Medical College & Postgraduate Institute, Indore (M.P.), during the period from April 2021 to September 2022. A total of 100 cases were taken in the study. All patients with negative pre-operative urine culture were given a single shot of ceftazidime 1g IV 2 h before the urological procedure and patients who had a positive urine culture were treated with antibiotics for 3 to 5 days before surgery based on sensitivity. Stone fragments were aseptically collected during the procedure and were sent for culture and antibiotic sensitivity.The study was approved by the Ethics Committee. Each patient was included after receiving her informed consent.

INCLUSION CRITERIA

- Age 18-80 years
- All patients with renal stone size more than 10mm in largest dimension,whose stone burden was calculated by multiplying the largest two dimensions
- Patients without prior treatment or instrumentation who have renal calculi.

EXCLUSION CRITERIA

- Patients with urogenital malignancy, others causes of sepsis.
- Any previous procedures or manipulations done
- Patients with severe immune compromised (diabetes, HIV etc.).
- Patients with a stent, nephrostomy tube or indwelling catheter
- Patients not giving consent for the study.

METHODOLOGY

All patients had standard diagnostic procedures, including renal function tests, x-ray, ultrasound, intravenous, and CT urograms. Our normal approach calls for testing the patient's midstream bladder urine week before the planned procedure and treating them with the proper antibiotics in accordance with the culture and sensitivity reports to sterilize the urine before PCNL. As per our institution's protocol, all patients received IV Ceftazidime prior to being put under anaesthesia. Urine from the midstream bladder was taken one day before the procedure. A 5F ureteral catheter was retrogradely placed into the ipsilateral ureter with a standard cystoscope while the patient was under general anaesthesia and strict asepsis preparation with betadine. A retrograde pyelogram was then taken. The patient is moved to the prone position.

Using the Triangulation technique/ Bull's eye approach, an 18-gauge needle puncture was made into the proper calyx while being guided by the C arm. After a successful puncture into the collecting system, the first aspirated urine is collected, labelled as "Pelvic urine," and sent for sensitivity testing and culture. A 0.035-inch terumo guide wire was inserted into the pelvis or ureter and coiled into the collecting system. Then, under fluoroscopic guidance, many serial dilatations utilising an Amplatz dilator set with dilators ranging from 8F to 28F are performed. After that, a 30F Amplatz sheath was advanced over a 28F dilator.

The stones were found by nephroscopy. Low pressure irrigation and a pneumatic lithotripter were used for the procedure. The pieces were pulled out. After fluoroscopy confirmation that all stone pieces have been removed, a 20-fr percutaneous nephrostomy drain was inserted, and the Amplatz sheath was withdrawn. Nemoy&Stamey Technique was used to prepare the retrieved stones before sending them as stone culture & sensitivity.

OBSERVATIONS AND RESULTS

Table 1: Basic parameter of the patients

	Number	Percentage
Gender		
Male	62	62
Female	38	38
Age	47.25±4.69	
Location of stone		
Renal stone	100	100
Stone Size (mm)	34.89±3.96	
Operative	104.63±9.89	

Time (minutes)		

Table 2: Preoperative and Post Operative culture

Preoperative Urine Culture	Number	Percentage
Negative	73	73
Positive	27	27
Post Operative Stone Culture		
Negative	45	45
Positive	55	55

Table 3: Culture results

Mid-stream urine culture	***E. coli***	**9**	**33.33**
	Pseudomonas	7	25.93
	Enterococcus	3	11.11
	Enterobacter	4	14.81
	Coagulase negative staph	2	7.41
	Klebsiella species	2	7.41
Intra-operative stone culture	Pseudomonas	18	32.73
	Enterobacter	11	20
	E. coli	9	16.36
	Coagulase-positive staph aureus	9	16.36
	Enterococcus	3	5.45
	Proteus	2	3.64
	Citrobacter	1	1.82
	Klebsiella species	2	3.64

Of the 100 cases of urolithiasis enrolled in this study, 62% were male and 38% were female (M/F ratio was 1.63:1) with mean age of 47.25±4.69 years. Among the study population, 27% had a positive pre-operative urine culture, whereas 55% patients were positive for stone culture (Table 2). Most common bacteria isolated in urine culture were *E. Coli* (33.33%), followed by Pseudomonas (25.93%), Enterococcus (11.11%), Enterobacter (14.81%), coagulase- negative Staphylococcus aureus and Klebsiella 7.41% each). The most common bacteria isolated in stone culture was Pseudomonas followed by Enterobacter, *E. coli* and others (Table 3).

DISCUSSION

Before proceeding with any stone operation, it has been common practise to get an MSU culture. In most cases, this procedure takes place at least a week before the operation, after which the affected area is treated with the proper antibiotics for three to five days. After that, it is done once again to ensure that the urine is completely sterile. Prophylactic antibiotic treatment is administered prior to endourological procedures in accordance with established standards [9]. Patients may nevertheless acquire systemic infections, and these infections can occasionally be disastrous [10, 11], even with excellent pre-operative preparation and clean urine cultures. According to the research that has been conducted, post-PCNL sepsis may develop in 10–15% of patients [12].

There are a number of risk factors that have been linked to sepsis, the most prevalent of which are the length of time the surgery takes, the amount of germs in the urinary tract, the degree of blockage caused by the stone, and infection inside the stone [7]. Using a nephrostomy tube, having renal insufficiency, having a large volume of irrigation fluid utilised, and having high fluid pressure during the operational process are some of the other risk factors that have been identified in the research [8, 13, 14]. It is standard protocol to get a pre-operative mid-stream urine culture, and the surgery is carried out with antibiotics depending on the findings of the culture obtained from the urine.

On the other hand, a number of writers have observed a poor concordance between the organism in the stone and the specimens of urine taken from the bladder [12, 15]. Stone culture was positive in 77% of the patients in the series that was conducted by Fowler and colleagues; however, a contemporaneous bladder urine sample was only positive in 12.5% of the patients [16]. MSU culture was positive in only 11.1% of patients, but stone culture was positive in 35.2% of cases, according to another research that was conducted by Mariappan et al. [7]. This finding indicates that there is a discordance between urine and stone culture. Moreover, Devraj et al. reported in 2016 that stone culture was positive in 30.1% of patients, but MSU positivity was recorded in only 10.8% of patients [17].

According to the findings of our research, the stone culture was positive in 55% of patients, whereas the mid-stream urine culture was positive in only 27% of patients. In addition, we found that urine culture has a low sensitivity, specificity, PPV, NPV, and diagnostic accuracy when it comes to predicting whether or not stone culture is positive. Stone cultures were found to be positive in significantly larger patients (55%) as compared to pre-operative MSU cultures (27%) (p value 0.0001), which was another interesting finding from our research. Urine cultures and stone cultures differ significantly in cases of renal stones, where stone cultures were found to be positive in significantly larger patients. On the other hand, this was not the case with bladder stones. Since no positive results were found in any of the cultures taken from individuals with ureteric stones, it is impossible to draw any associations, which severely constrains our ability to interpret the same. The above finding that there is a difference between MSU and stone cultures seems to be particularly significant in terms of its application to instances of renal stones.

Infections caused by gram-positive organisms make up a smaller percentage of the microbiology of stones and urine [18]. Gram-negative bacteria account for the majority of the illnesses. According to the results of our research, the organisms Pseudomonas aeruginosa and Enterobacter were the most often recovered from stone cultures, while E. coli and Pseudomonas were the most frequently isolated from urine cultures. These findings are consistent with the literature that is currently available [18]. Nevertheless, we did notice that the organisms that were recognised most often in each sample were different, which was something that was also discovered in the research conducted by MC Songra et al in 2015 [6]. They also discovered in their research that the bacteriology of stones was a stronger predictor of post-operative sepsis than urine culture. This was one of their findings. In their investigation, Annerleim Walton-Diaz et al also proved that urine culture and stone cultures did not match up, and they found that a strong correlation existed between post-operative sepsis and intraoperative stone cultures rather than pre-operative urine culture [12].

So, kidney stones have a greater potential of harbouring germs as compared with urine, and a culture of the urine that is negative does not always rule out the possibility of infection inside the stone. In addition, the microbiological environment of the stone is quite unlike to that which is seen in urine. Because of this, stones continue to be one of the most significant contributors of sepsis after surgery. Many investigations have shown a favourable correlation between stone culture and post-operative sepsis, particularly in instances when pre-operative urine cultures were negative [6, 7, 12, 17]. At the time of operation, stone cultures may be acquired without much difficulty and at a negligible extra expense. This not only shortens the length of time a patient must remain in the hospital, but it also lowers the total expense of treating an episode of post-operative sepsis. This not only shortens the length of time a patient must remain in the hospital, but it also lowers the total expense of treating an episode of post-operative sepsis. As a result of this investigation, the significance of intra-operative stone culture in addition to the usual use of urine culture has been brought to light.

CONCLUSIONS

Urine culture has a low predictive value and accuracy when it comes to determining the bacteriology of stone; as a result, it cannot be utilised as a surrogate marker for this condition. When it comes to cases of renal stones, this is where its clinical significance is at its highest. As a result, collecting stone cultures during PCNL is an important procedure that ought to be incorporated into the standard operating procedure.

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