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The Importance of Urine Culture Investigation in Patients with Large Renal Stones: A Single Clinical Study

Flatra Fetahi[1], D. Çuni[1], I. Miftari[2,1], Xh. Çuni[3,2], S. Mehmeti[2], A. Neziri[2], A. Elshani[2], L. Selmani[2], B. Gllareva[1], L. Çuni[2], D. Hoxha[2], E. Çuni[4]

[1]*Faculty of Medicine, University of Prishtina, Prishtina, Kosovo*
[2]*University Clinical Centre, Prishtina, Kosovo*
[3]*UNI College, Arizona State University, Tempe, AZ, USA*
[4]*Alma Mater Europaea Campus College "Rezonanca," Prishtina, Kosovo*

Abstract

Background: The increased prevalence of kidney stone disease is considered a global health pandemic. Seeing that in many studies, there are differences in the presentation of this problem depending on the geographical distribution of the countries and on the age and gender of the patients, we have tried to present some study data carried out in Kosovo. We aimed to verify the presence of the urinary bacteriological agent through examining urine culture in 127 selected patients with large renal stones (>4.5 cm) in the Clinic of Urology (Prishtina, Kosovo) in a cohort study from September 2000 to September 2025.

Methods and Results: All patients completed the necessary lab test and CT KUB. Bacteriological culture of urine before surgery and analysis of stone composition after surgery were analyzed individually for each patient. According to the appearance of the stone, patients were divided into two main groups: Group 1 included 114 patients (70 women and 44 men) with branched stones, and Group 2 included 13 patients (7 men and 6 women) with unbranched stones. In Group 1, 60.5% of cases were confirmed positive culture. The positive cultures dominated in women (69.6%). *Proteus* was the most frequent (21.1%), followed by *Pseudomonas* (12.3%), *Enterococcus* (9.6%), *Klebsiella* (7.9%), *Staphylococcus aureus* (5.3%), and *E. coli* (4.4%). Regarding the chemical analysis of participants in this group, the most common type was the struvite stones (57.0%), followed by a mixed type composed of calcium oxalate (CaOx) and calcium phosphate ($CaPO_4$) in 3.5% of cases. In Group 2, the positive culture was identified in 46.2% of cases, and sterile culture was in 53.8% of cases, and there was no significant difference between Groups 1 and 2. *E. coli* was the most frequent (30.8%), followed by *Klebsiella* (15.4%). According to the type of bacteria isolated, there was a significant difference between groups (P=0.003). Regarding the chemical analysis, in Group 2, the most common type was the stones composed of calcium content (CaOx and $CaPO_4$) in 11(84.6%) cases, followed by acid uric composition in two cases (15.4%). According to the composition of the stones, we obtained a significant difference between the groups (P=0.000).

Conclusion: In patients with branched stones, the main bacteria isolated is *Proteus*, and the chemical composition was struvite. In patients with unbranched stones, the dominant bacteria isolated is *E. coli*, and the dominant chemical composition is calcium. (**International Journal of Biomedicine. 2025;15(1):146-149.**)

Keywords: renal stone • urinary tract infection • urine culture

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Abbreviations

BS, branched stones; **UBS**, unbranched stones; **USD**, urinary stone disease; **UTIs**, urinary tract infections

Introduction

The increased prevalence of urinary stone disease (USD) is considered a global health pandemic. Urinary stone diseaseis an increasing clinical problem in both children and adults. One in ten individuals will experience a urinary stone, yet the mechanisms responsible for urinary stones remain largely unknown.[1] Over the past decade, significant

advances have been made in understanding the pathogenesis, diagnosis, and treatment of USD. We have analyzed a series of papers presented by many authors on the MEDLINE and PubMed platforms to examine the multifactorial impact on the appearance of urolithiasis in selected regions worldwide. We will quote some of these in the introduction. The pathogenetic mechanisms of kidney stone formation are complex and involve metabolic and environmental risk factors. Whereas all non-infection urinary stones originate because of metabolic disturbances or through unknown changes, infection stones occur only in connection with urinary tract infections (UTIs).[2,3] Sakhaee documented that nephrolithiasis has become increasingly recognized as a systemic disorder that is associated with chronic kidney disease, nephrolithiasis-induced bone disease, increased risk of coronary artery disease, hypertension, type 2 diabetes mellitus, and metabolic syndrome.[4] Ljunghall et al.[5] reported a higher percentage of kidney stones in first-degree relatives and family members with kidney stones, showing a greater concordance with renal stone incidence in monozygotic than dizygotic twins. According to Miano's study, the relationship between urinary stones and UTIs is well known. There are two different clinical pictures: (1) stones that develop following UTIs (infection stones), which play a key role in stone pathogenesis, and (2) stones complicated by UTIs (stones with infection), which are metabolic stones that passively trap bacteria from coexistent UTIs and may consist of calcium or non-calcium.[6] Seeing that in many studies, there are differences in the presentation of this problem depending on the geographical distribution of the countries and on the age and gender of the patients, we have tried to present some study data carried out in Kosovo.

We aimed to verify the presence of the urinary bacteriological agent through examining urine culture in 127 selected patients with large renal stones (>4.5 cm) in the Clinic of Urology (Prishtina, Kosovo) in a cohort study from September 2000 to September 2025.

Materials and Methods

All patients completed the necessary lab test and CT KUB. Bacteriological culture of urine before surgery and analysis of stone composition after surgery were analyzed individually for each patient. Written informed consent was obtained from all participants.

Statistical analysis was performed using the statistical package InStat 3 (free version). Baseline characteristics were summarized as frequencies and percentages. Group comparisons were performed using the chi-square test.

Results

From the demographic data, most patients treated for large renal stones were residents of rural places, 48.8%, compared to 37.8% from urban places, and 11.8% were abroad residents. According to gender, 40.2% were male and 59.8% were female. The average age of patients was 43 years in the range of 21-71 (Table 1). According to clinical evaluation, about 50.3% of patients were asymptomatic. Location of stone: on the right kidney was discovered in 52.7% of cases and on the left in 47.3%. According to the appearance of the stone, patients were divided into two main groups: Group 1 included 114 patients (70 women and 44 men) with branched stones (BS), and Group 2 included 13 patients (7 men and 6 women) with unbranched stones (UBS) (Table 2).

Table 1.

General characteristics of the study patients.

Total	n	%
	127	100.0
Gender		
Male	51	40.2
Female	76	59.8
Age		
Mean (range), years	43.0 (21-71)	
Residence		
Urban	48	37.8
Rural	62	48.8
Abroad residents	15	11.8

Table 2.

Clinical evaluation of the study patients.

Total	127	100.0%
Symptoms		
Asymptomatic	64	50.4%
Symptomatic	63	49.6%
Stone location		
Right kidney	67	52.8%
Left kidney	60	47.2%
Stone appearance		
Branched stones	114	89.8%
Unbranched stones	13	10.2%

In Group 1, 60.5% of cases were confirmed positive culture. The positive cultures dominated in women (69.6%). *Proteus* was the most frequent (21.1%), followed by *Pseudomonas* (12.3%), *Enterococcus* (9.6%), *Klebsiella* (7.9%), *Staphylococcus aureus* (5.3%), and *E. coli* (4.4%). The patients with sterile culture had at least one positive culture response for infection in their medical records in less than 3 months. Regarding the chemical analysis of participants in this group, the most common type was the struvite stones (57.0%), followed by a mixed type composed of calcium oxalate (CaOx) and calcium phosphate ($CaPO_4$) in 3.5% of cases.

In Group 2, we did not obtain significant statistical differences by gender. The positive culture was identified in 46.2% of cases, and sterile culture was in 53.8% of cases, and there was no significant difference between Groups 1 and 2. *E. coli* was the most frequent (30.8%), followed by *Klebsiella* (15.4%). According to the type of bacteria isolated, there was a significant difference between groups (*P*=0.003). Regarding the chemical analysis, in Group 2, the most common type was the stones composed of calcium content (CaOx and $CaPO_4$) in 11(84.6%) cases, followed by acid uric composition in two cases (15.4%). According to the composition of the stones, we obtained a significant difference between the groups (*P*=0.000) (Table 3).

Table 3.

Clinical characteristics of the study groups.

Clinical characteristics	Croup 1 (BS)		Group 2 (UBS)		*P*-value
	114	100.0	13	100.0	
Gender					
F	70	61.4	6	46.2	0.288
M	44	38.6	7	53.8	
Urine culture					
Positive	69	60.5	6	46.2	0.318
Sterile	45	39.5	7	53.8	
Isolated bacteria					
Proteus	24	21.1	-	-	0.003
Pseudomonas	14	12.3	-	-	
Enterococcus	11	9.6	-	-	
Klebsiella	9	7.9	2	15.4	
Staphylococcus aureus	6	5.3	-	-	
E. coli	5	4.4	4	30.8	
Stone composition					
CaOx /$CaPO_4$	4	3.5	11	84.6	0.000
Acid uric composition	-	-	2	15.4	
Struvite stones	65	57.0	-	-	

Discussion

The focus of this study was to present the importance of periodic examinations to prevent and reduce this pathology in the Kosovar population. The high frequency of the appearance of large kidney stones and the challenge of their treatment still constitute a threat to the health of the population throughout the globe. According to many authors, a series of studies have shown that branched stones are more likely to be infectious than unbranched stones. These clinical data are useful for choosing antibiotics to prevent urinary sepsis. This was also why we continuously divided our patients into two study groups, and we successfully carried out prevention with different antibiotics. It has been demonstrated that in patients with large BS, the main bacteria isolated was *Proteus*, and the chemical composition was struvite. In patients with UBS, the dominant bacteria isolated was *E. coli*, and the dominant chemical composition was calcium.

According to the study by Schwartz et al.,[7] the dominance of Proteus was verified in the positive urine cultures of his patients. Other isolated bacteria were *Klebsiella*, *Pseudomonas*, and *Staphylococcus*. Flannigan has confirmed in his study that infection, especially from urea-splitting bacteria, had increased urine pH to 7.2, enabling struvite precipitation and BS formation.[8] The benefits of these studies are multiple, especially in the prevention of urosepsis. In our clinical work, we routinely use antibiotics containing cephalosporins in patients with large BS because there is a high probability of urea-splitting bacteria, and the chances of resistance to this antibiotic are higher. This situation is quite different in patients with large unbranched stones, where *E. coli* and non-urea-splitting bacteria are expected to dominate, and their sensitivity to cephalosporins is expected to be higher.

Conclusion

Many similar studies can be found on the PubMed and MEDLINE platforms that show the connection between urinary infection and urinary stone disease and its clinical importance in the protection of patients' health, especially from urosepsis. Even though the urine culture results give us important data on the participation of different bacteria in the infection, they do not include all the possible causes of the infection.

There are some reports on the possibility that bacteria are underrepresented. As a weakness, it is noted that currently, the standard urine culture protocols used by clinical microbiologists are only designed to identify clinical infections from known uropathogens. These protocols are not conducive to growth from slow-growing, fast-growing, or anaerobic bacteria, which comprise most of the bacteria in the urine.[9-13] This will certainly be considered in future studies to enable better prevention of urinary tract infection and urinary stone disease.

Competing Interests

The authors declaresthat there are no competing interests.

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***Corresponding author:** *Dr Ilir Miftari PhD. University Clinical Centre, Prishtina, Kosovo. E-mail: ilirmiftari@gmail.com*