

Risk Factors Analysis for Occurrence of Asymptomatic Bacteriuria After Endourological Procedures

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ABSTRACT

Introduction: Endourological procedures are performed according to the principles of aseptic techniques, yet still in certain number of patients urinary tract infections may occur. Considering the risk of urinary tract infection, there is no unique opinion about the prophylactic use of antibiotics in endourological procedures. **Goal:** The objective of this study was to determine the connection between endourological procedures and occurrence of urinary infections and to analyze the risk factors of urinary infection for patients who were hospitalized at the Urology Clinic of the Clinical Center University of Sarajevo CCUS. **Materials and Methods:** The research was conducted as a prospective study on a sample of 208 patients of both genders, who were hospitalized at the Urology Clinic of the CCUS and to whom some endourological procedure was indicated for diagnostic or therapeutic purposes. We analyzed data from patient's histories of illness, laboratory tests taken at admission and after endourological procedures, also surgical programs for endoscopic procedures. All patients were clinically examined prior to endoscopic procedures while after the treatment attention was focused to the symptoms of urinary tract infections. **Results:** Statistical analysis of the tested patients indicates that there is no significant difference in the presence of postoperative, compared to preoperative bacteriuria, which implies that the endourological procedures are safe procedures in terms of urinary tract infections. Preoperatively, the most commonly isolated bacteria was *Escherichia coli* (30.9%) and postoperatively, *Enterococcus faecalis* (25%). Statistically significant effect on the occurrence of postoperative bacteriuria has preoperative bacteriuria, duration of postoperative catheterization, and duration of hospitalization. **Conclusion:** In everyday urological practice, it is very important to identify and control risk factors for the development of urinary infection after endourological procedures, with main objective to minimize occurrence of infectious complications.

Key words: urinary infection, endourology, risk factors.

1. INTRODUCTION

Today in urology, traditional incision surgery is more and more replaced with endoscopic surgery. Endourological procedures imply the use of special instruments that are introduced into the urinary system through the urethra and percutaneous techniques that allow ante grade access to the urinary tract (1, 2). Use of endourological procedures enables visualization of the entire urinary tract from the urethra to the kidneys and to perform surgical procedures on these organs.

The risk of urinary tract infection after endourological procedures and the use of antibiotic prophylaxis for these procedures is a question about which there is no unique opinion (3-6). Practice has proved that every urological procedure with use of instruments is associated with an increased risk of urinary tract infections and bacteremia.

Classification of transurethral surgery according to Cruise and Ford into clean, clean-contaminated and contaminated is more complex, compared to open urological surgical procedures (7-10). Traditionally endourological

procedures are classified as clean-contaminated, because the genitourinary tract is colonized with micro flora, even in case of sterile urine presence (10-12).

The importance of risk factors for urinary tract infections as a result of endourological procedures is not yet known. Risk factors related to the patient are combined, for example, in one patient we found multiple factors and it is difficult to determine the significance of certain factors.

There are no international standards for the assessment of risk factors for the development of urinary infections after endourological procedures. EAU/ESIU announced a new categorization of risk factors for urinary infections, called ORENUC system (13).

The name classification system ORENUC itself is an acronym: O-NO known factors; for R-Risk for Recurrent UTI; E-Extra urogenital risk factors; N-Nephropathy; U-Urological risk factors that can be resolved by therapy; C-catheter and the risk factors that cannot be resolved by therapy. It means that according to the present system of

risk factors for urinary infection classification ORENUC the risk factors are divided into six groups (14).

Today the general risk factors for urinary tract infections are known, such as patients of older age, immune deficiency, malnutrition, obesity, diabetes mellitus, smoking, hypoalbuminemia. In order to assess the general risk factors related to the patient the ASA score is used, which is primarily focused on the assessment of anesthetic risk, but also indicates the general health of the patient. The higher the ASA score the greater is the risk of infectious complications. As specific risk factors for the development of urinary tract infection are considered preoperative bacteriuria, urethral catheter, stones in the urinary tract and a history of previous urogenital infections (15).

2. GOAL

The objective of this study was to determine the connection between endourological procedures and occurrence of urinary infections and to analyze the risk factors of urinary infection for patients who were hospitalized at the Urology Clinic of the Clinical Center University of Sarajevo CCUS.

3. MATERIAL AND METHODS

The research was conducted as a prospective study on a sample of 208 patients of both genders, who were hospitalized at the Urology Clinic of the CCUS and to whom one of endourological procedures was indicated either for diagnostic or therapeutic purposes. We analyzed data from patient histories, laboratory tests taken at admission and after endourological procedures, and also the operational programs for endoscopic procedures. All patients were clinically examined prior to endoscopic procedures and after the treatment attention was focused on the symptoms of urinary tract infections. Upon hospitalization at the Urology Clinic, from all patients were taken midstream, first morning urine for bacteriological examination, for three consecutive days and then again urine was taken 48 hours after the endoscopic procedure (also for three consecutive days). All data are presented in charts by absolute number of cases, relative number of cases, mean with standard deviation, standard error of mean and range of values. Data analysis was performed using the statistical package IBM SPSS Statistics v21.0, MedCalc v12.7 and Microsoft Excel 2010.

4. RESULTS

Research results are presented on tables 1-4.

Analysis of the presence of postoperative bacteriuria shows that it has been more common in men or in 48 cases (28.1%) compared to women with 8 cases (21.6%). Statistical analysis indicates that there is no significant difference in the presence of postoperative bacteriuria in relation to gender ($p > 0.05$). There was no statistically significant difference in the prevalence of postoperative bacteriuria by age groups ($p > 0.05$). Preoperative catheterization was statistically significantly more present in patients who have had a postoperative bacteriuria (16 or 28.6%) compared to those without bacteriuria (8 or 5.3%) ($p < 0.05$). Postoperative catheter was placed in almost all cases—196 patients or 94.2%, or it was not places only in

individual cases after cystoscopy and urethral stent installation. The duration of postoperative catheterization, with the exclusion of nine patients who were discharged with a catheter, was 3.9 ± 2.1 days, with the longest postoperative catheterization of 20 days.

Analysis of the average duration of postoperative catheterization (with the exclusion of nine patients who were discharged with a catheter), shows that patients with postoperative bacteriuria had longer duration of postoperative catheterization of 1.97 ± 0.14 days (range 1-20 days) compared to those without postoperative bacteriuria with 1.4 ± 0.4 days (range 0-5 days) and with a statistically significant difference ($p < 0.05$). We did not record a statistically significant difference in the prevalence of postoperative bacteriuria according to the type of surgery ($p > 0.05$).

Also a statistically significant difference in the presence of postoperative bacteriuria by the presence of comorbid diseases was not recorded ($p > 0.05$). Antibiotic prophylaxis in relation to the occurrence of postoperative bacte-

		Period	
		Preoperative	Postoperative
E.coli	N	15	12
	%	27,3	21,4
E.coli ESBL	N	2	1
	%	3,6	1,8
Enterococcus faecalis	N	11	14
	%	20	25
Enterococcus faecium	N	3	4
	%	5,4	7,1
Pseudomonas aeruginosa	N	3	5
	%	5,4	8,9
Proteus mirabilis	N	5	3
	%	9,1	5,3
Staphylococcus epidermidis	N	4	4
	%	7,3	7,1
Staphylococcus hominis	N	0	1
	%	,0	1,8
Streptococcus agalactiae	N	3	2
	%	5,4	3,6
Klebisella pneumoniae	N	1	4
	%	1,8	7,1
Enterobacter aerogenes	N	0	1
	%	,0	1,8
Enterobacter aerogenes ESBL	N	2	2
	%	3,6	3,6
Enterobacter cloacae	N	3	0
	%	5,4	,0
Acinetobacter baumannii	N	1	2
	%	1,8	3,6
Candida albicans	N	2	1
	%	3,6	1,8
Total	N	55	56
	%	100,0	100,0

Table 1. Isolated causes of urinary infections before and after endourological procedures. $\chi^2=9,828$; $p=0,774$

		Bacteriuria postoperative		Total
		No	Yes	
			N	
Endourology procedures	TURB + TUR biopsio mucosae v.u	61	22	83
		% 40,1	39,3	39,9
	TURP	31	17	48
		% 20,4	30,4	23,1
	TUIP	5	1	6
		% 3,3	1,8	2,9
	Urethrotomia interna	20	5	25
		% 13,2	8,9	12,0
	TUI colli v. urinariae	15	6	21
		% 9,9	10,7	10,1
	double-J stent or ureteral catheterization	8	2	10
		% 5,3	3,6	4,8
	Urethrocystoscopy	7	1	8
		% 4,6	1,8	3,8
	URS	0	1	1
		% 0,0	1,8	0,5
Lithotripsy	2	0	2	
	% 1,3	0,0	1,0	
Litotripsy in combination with TUI colli v.u or urethrotomia interna	3	1	4	
	% 1,9	1,8	1,9	
Total	N 152	56	208	
	% 100,0	100,0	100,0	

Table 2 . Ratio of endourology procedures and postoperative bacteriuria. $\chi^2=7,438$; $p=0,592$

riuria did not show a statistically significant difference ($p > 0.05$). Analysis of the average values indicate that there is a statistically significant difference according to the presence of postoperative bacteriuria in relation to the hospitalization duration, as preoperative and postoperative, as well as total duration of hospitalization ($p < 0.05$).

Analysis of the correlation coefficient indicates that a statistically significant effect on the occurrence of postoperative bacteriuria have preoperative bacteriuria, duration of postoperative catheterization and duration of hospital stay, as well as the total duration of hospitalization before and after endourological treatment ($p < 0.05$).

5. DISCUSSION

It is known that urinary infections occurs most often through downward pathway and are usually caused by bacteria that are part of the physiological intestinal micro flora (1-10). A potential source of bacteria that cause urinary tract infections include urethral flora, colonization of the bladder, perioperative contamination or periurethral adenoma in men. It is sometimes difficult to distinguish bacteriuria caused after urological instrumentation from urine contamination with periurethral flora (11-16).

The most common cause of UTIs is *E. coli*, and in complex infections with a greater incidence of infection also occurring other bacteria such as *Proteus spp.*, *Klebsella spp.*, *Enterobacter spp.*, *Pseudomonas spp.*, *Acinetobacter spp.*

		Bacteriuria postoperative		Total
		No	Yes	
			N	
Comorbidity	Without comorbidity	63	20	83
		% 41,4	35,7	39,9
	Anemia	1	0	1
		% 0,7	0,0	0,5
	Diabetes mellitus, gastrointestin diseases	0	1	1
		% 0,0	1,8	0,5
	Diabetes mellitus	7	1	8
		% 4,6	1,8	3,8
	Hypertension	27	7	34
		% 17,6	12,7	16,3
	Hypertension, Diabetes melitus	5	2	7
		% 3,3	3,6	3,4
	Hypertension, hip-erthieosis	1	1	2
		% 0,7	1,8	1,0
	Hypertension, hy-pothyreosis	0	2	2
		% 0,0	3,6	1,0
	Hypertension, car-diovascular diseases	10	7	17
		% 6,5	12,7	8,2
	Hypertension, car-diovascular diseas-es, anemia	0	1	1
		% 0,0	1,8	0,5
	Hypertension, car-diovascular diseas-es, Diabetes mellitus	2	0	2
		% 1,3	0,0	1,0
	Hypertension, car-diovascular diseas-es, stroke	0	1	1
		% 0,0	1,8	0,5
	Hypertension, stroke	0	1	1
		% 0,0	1,8	0,5
Hypertension, re-spiratory diseases	1	1	2	
	% 0,7	1,8	1,0	
Cardiovascular diseases	27	5	32	
	% 17,6	9,1	15,4	
Cardiovascular diseases, anemia	2	0	2	
	% 1,3	0,0	1,0	
Cardiovascular diseases, Diabetes mellitus	3	1	4	
	% 2,0	1,8	1,9	
Cardivascular and gastrointestinal diseases	1	0	1	
	% 0,7	0,0	0,5	
Cardiovascular and respiratory diseases	0	1	1	
	% 0,0	1,8	0,5	
Cardiovascular diseases, stroke	0	2	2	
	% 0,0	3,6	1,0	
Stroke	1	1	2	
	% 0,7	1,8	1,0	
Respiratory diseases	1	1	2	
	% 0,7	1,8	1,0	
Total	N 152	56	208	
	% 100,0	100,0	100,0	

Table 3. Comorbidity and postoperative bacteriuria. $\chi^2=7,438$; $p=0,592$

		Bacteriuria post-operative		Total	
		Ne	Da		
Antibiotic prophylaxis preoperative	Cefazolin	N	13	7	20
		%	8,6	12,5	9,6
	Ceftriaxon	N	108	34	142
		%	71,1	60,7	68,3
	Ciprofloxacin	N	13	6	19
		%	8,6	10,7	9,1
	Meropenem & Imipenem	N	3	2	5
		%	1,9	3,6	2,4
	Amoxicillin/ clavulonic acid	N	15	7	22
		%	9,9	12,5	10,6
Total	N	152	56	208	
	%	100,0	100,0	100,0	

Table 4. Antibiotic prophylaxis and postoperative bacteriuria. $\chi^2=2,216$ $p=0,696$

Use of antibiotic prophylaxis in high-risk patients is accepted and even recommended practice, but use in low-risk patients remains a controversial issue, especially about the type and duration of antimicrobial treatment.

Most authors agree that in low-risk endourological procedures, in the absence of risk factors and if the preoperative urine sample is sterile, antibiotic prophylaxis may be unnecessary. In the preoperative preparation of patients, any infections, especially urinary tract infections must be verified and treated. If an infection is present and intervention cannot be delayed, antibiotic therapy should be given on an empirical basis before surgery and then continued after surgery, while it is desirable to be done according to the antibiotic resistance chart when it is available.

Preoperative urinary infections, especially recurrent, are recognized as a high risk for postoperative infection and must be treated before the surgery. The importance of preoperative bacteriuria is not yet sufficiently established, but it is proven that patients with preoperative bacteriuria have higher incidence of gastroenteritis and sepsis.

One result of our study is that preoperative bacteriuria which is found in 26.4% patients had a statistically significant effect on the occurrence of postoperative bacteriuria.

The risk of urinary tract infections after endourological procedure depends on the type of procedure performed, wherein the TUR of the prostate is associated with the highest risk of urinary tract infections. In this study, we did not find significant difference in the occurrence of postoperative bacteriuria between individual endourological procedures.

Cystoscopy is the most commonly endourological procedure performed which belongs to clean procedures. According to studies cystoscopy is relatively safe procedure. The incidence of symptomatic urinary tract infection after cystoscopy with preoperatively sterile urine sample is 5% and the incidence of asymptomatic bacteriuria is between 10% and 35%. In this study, the percentage of bacteriuria after cystoscopy is 1.8%. Since cystoscopy is the most common endourological outpatient procedure,

it is very important that it belongs to safe procedures with very few complications.

Compared with transurethral resection of the prostate, there is less data on infectious complications after transurethral resection of the bladder tumors. According to the literature, urinary infection after TURBT occurs in 2-39% of patients. Frequently endourological operations in hospitalized patients at the Urology Clinic are transurethral resection of bladder tumors. In this study in 25.3% of 83 patients who underwent TURBT was verified postoperative bacteriuria.

After TURBT, most performed surgical procedure is TUR of the prostate. In a systematic review, Bootsma and colleagues concluded that "except for TURP and biopsy of the prostate, lacking a well performed studies that examined the need for antibiotic prophylaxis for endourological procedures". In patients who were scheduled for TURP and who do not have a urethral catheter, preoperative bacteriuria is found in more than 10%. Bacteriuria at the time TURP is performed increases the risk of febrile infection by 5-10%. In a meta-analysis of 32 studies, Berry and Barrett found the percentage of postoperative bacteriuria in 26% of 4260 patients and septicemia in 4.4%. According to other studies in 6-70% of patients bacteriuria occurs postoperatively. Febrile or symptomatic infection in 5-10% of cases and in sepsis 0-4%, with a mortality rate of 13%, which increases to 20% in men over 64 years of age.

Clinical trials have demonstrated that prophylaxis is effective in men who are subject to prostate TUR, but studies that have evaluated other procedures are limited. It is assumed that the risk of sepsis is similar like in any similar followed by mucosal bleeding and that antimicrobial therapy will produce similar benefits for all of these procedures. Studies have shown that a single dose or short administration of antibiotics (<72 h) reduces urinary tract infection in 66% and 71%. In this study of 48 patients who underwent TUR of the prostate, in 35.4% was verified postoperative bacteriuria.

Our results show that preoperative catheterization was statistically significantly more present in patients who had postoperative bacteriuria (16 or 29.1%) compared to those without (8 or 5.2%). Analysis of the average duration of postoperative catheterization (with the exclusion of nine cases that were dismissed with still placed catheter), shows that patients with postoperative bacteriuria had placed catheter for 1.97 ± 0.14 days (range 1-20 days) compared to those without postoperative bacteriuria with 1.4 ± 0.4 days (range 0-5 days) and with a statistically significant difference.

In the literature, there is data that preoperative catheter significantly increase the incidence of bacteriuria before and after TURP or from 53% to 100%. Nosocomial bacteriuria develops in 25% of patients with catheter placed for more than 7 days with daily risk of 5%. Each additional day of catheterization is associated with a further risk increase by 3-10% for developing bacteriuria. Bacteriuria which occurs after catheterizations that was short lasting, usually asymptomatic and is caused by a single microorganism.

Extra luminal path for spread of bacteria, with the placed catheter involves the direct inoculation of the bacteria during the insertion of the catheter, and the other

way is by migration within mucosal coating that is on the outside of the catheter. These bacteria are endogenous, originating from the gastrointestinal tract. Microorganisms can also enter through intraluminal space, when is enabled entry of the microorganisms through the lumen of the catheter due to the lack of a closed drainage system or contamination of urinary bags. These microorganisms originate from the outer environment, for example, hands of health care professionals, which is very important for the prevention of urinary tract infections associated with urethral catheter.

6. CONCLUSIONS

Statistical analysis of the tested patients indicates that there is no significant difference in the presence of postoperative, compared to preoperative bacteriuria, which implies that the endourological procedures are safe procedures in terms of urinary tract infections. Preoperatively, the most commonly isolated bacteria was *Escherichia coli* (30.9%) and postoperatively, *Enterococcus faecalis* (25%). Statistically significant effect on the occurrence of postoperative bacteriuria has preoperative bacteriuria, duration of postoperative catheterization, and duration of hospitalization. In everyday urological practice, it is very important to identify and control risk factors for the development of urinary infection after endourological procedures, with main objective to minimize occurrence of infectious complications.

CONFLICT OF INTEREST: NONE DECLARED.

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