Turkish Journal of Medical Sciences

Volume 40 | Number 2 Article 22

1-1-2010

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DEFNE GÜMÜŞ

YAŞAR BAĞDATLI

TÜBİTAK

Original Article

Turk J Med Sci
2010; 40 (2): 317-322
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E-mail: medsci@tubitak.gov.tr
doi:10.3906/sag-0805-47

A bacteriological examination of urine before and after urodynamic testing

Defne GÜMÜŞ, Yaşar BAĞDATLI

Aim: Urodynamic studies have been associated with an increased risk of bacteriuria and symptomatic urinary tract infection (UTI) because it is applied by invasive catheterization. In this study the value of antibiotic prophylaxis in decreasing the risk of bacteriuria and symptomatic UTI has been questioned in children.

Materials and methods: Urine samples of 90 patients, who were taken before and after urodynamic testing in Cerrahpaşa Faculty of Medicine Videourodynamics Laboratory of Child Surgery Department, were cultured microbiologically to determine the presence of bacteriuria.

Results: The rate of bacteriuria was found statistically higher in 50 patients under trimethoprim/sulphamethoxazole and 17 under nitrofurantoin prophylaxis after the urodynamics ($P < 0.05$) compared to pre-urodynamics. According to our results, the most frequently bacteria detected before urodynamic testing was *E. coli* (in 25 patients, 3 of them ESBL + strains) as it was the same as post-urodynamics.

Conclusion: As a result, we suggest that it will be necessary to evaluate prophylactic usage of trimethoprim-sulfamethoxazole and nitrofurantoin. The isolation of some nosocomial infectious agents is considered as another significant point of our study. ESBL + *E. coli* and *Enterococcus faecium* strains, which were isolated from patients under prophylaxis, showed the importance of this kind of surveillance studies.

Key words: Urodynamics, urine, bacteriuria, prophylaxis

Ürodinami işlemi öncesi ve sonrası idrarın bakteriyolojik incelenmesi

Amaç: Ürodinamik çalışmalar invazif kataterizasyon ile uygulandığından bakteriüri ve semptomatik üriner sistem infeksiyonu (ÜSİ) gelişimi açısından risk faktörü olarak karşımıza çıkmaktadır. Bu çalışmada çocuklarda bakteriüri ve semptomatik ÜSİ gelişme riskini azaltması açısından antibiyotik profilaksisinin etkinliği araştırılmıştır.

Yöntem ve gereç: Cerrahpaşa Tıp Fakültesi Çocuk Cerrahisi Anabilim Dalı videoürodinami laboratuarına başvuran 90 hastanın idrar örnekleri ürodinami işlemi öncesi ve sonrasında toplanmış, bakteriüri varlığı açısından mikrobiyolojik olarak incelenmiştir.

Bulgular: Profilaktik olarak trimetoprim/sülfametoksazol kullanan 50 ve nitrofurantoin kullanan 17 hastada saptanan bakteriüri oranlarında ürodinami öncesi durum ile kıyaslandığında işlem sonrasında istatistiksel olarak anlamlı bir artış olduğu bulunmuştur. Araştırmamız sonucunda; ürodinami işlemi öncesinde olduğu gibi sonrasında da en sık izole edilen bakteri *E. coli* (3'ü GSBL oluşturan suş olmak üzere 25 hasta) olmuştur.

Sonuç: Bulgular trimetoprim/sülfametoksazol ve nitrofurantoin'in profilaksi amacıyla kullanımını sorgulamak gerektiğini düşündürmüştür. Çalışmamızda önem taşıyan bir diğer nokta, az da olsa hastalarımızda nozokomiyal infeksiyon etkenlerinin saptanmış olmasıdır. Profilaksi altındaki hastalarda üreyen GSBL yapan *E. coli* ve ayrıca *Enterococcus faecium* kökenlerinin belirlenmesi sürveyans amaçlı bu tip çalışmaların önemini göstermektedir.

Anahtar sözcükler: Ürodinami, idrar, bakteriüri, profilaksi

Received: 20.05.2008 – Accepted: 09.09.2009

Department of Clinical Microbiology, Cerrahpaşa Faculty of Medicine, İstanbul University, İstanbul - TURKEY

Correspondence: *Yaşar BAĞDATLI, Department of Clinical Microbiology, Cerrahpaşa Faculty of Medicine, İstanbul University, İstanbul - TURKEY*
E-mail: yasarbagdatli@hotmail.com

Introduction

Urodynamics is a technique that is used for the investigation of lower and upper urinary tract, and peripheral and central nervous systems that controls the functions of these systems (1,2). This technique is also used by clinicians mostly to research the functions of lower urinary tract and especially to appraise the urinating problems caused by lower urinary tract diseases (3,4).

A videourodynamic study requires very expensive and complex equipments that are not available at many urological facilities. Moreover it uses radiation with its attendant problems and risks (2). For these reasons most urologists perform videourodynamics only in complex cases involving suspected anatomic abnormalities, failure of previous surgical procedures or associated neurological problems (2). Urodynamic studies have also been associated with an increased risk of bacteriuria and symptomatic urinary tract infection (UTI) because it is applied by invasive catheterization (2). Catheters are tools that destroy the host's immune systems and let microorganisms to enter normally aseptic sections. The most frequent complication of urinary catheterization is bacteriuria developing out of trauma and urethritis (5-7).

Catheter associated bacteriuria and UTI are among the most common nosocomial infections (5). NUTI (nosocomial urinary tract infections), which have been seen in 2%-3% of hospitalized patients are the most common nosocomial infections and include 30%-40% of all nosocomial infections (8,9). It was shown that bacteriuria can develop in 10%-27% of the catheterized patients within 5 days and in 30% of this group, in which 1%-5% are also septicemic, symptomatic UTI can occur (9-11).

Studies indicate that a low rate of significant bacteriuria (1%-4% in women and 2%-6% in men) occurs after urodynamic studies (2), but it was shown that there is a probability of an increase above 20% (4). It is important to assure that the patient has sterile urine before the procedure. After the urodynamic testing; *E. coli*, *Klebsiella* sp., *Proteus* sp. and *Enterococcus* sp. have been reported as the most frequently acquired bacterial agents (12). The benefit of antibiotic prophylaxis in patients without a history of UTI is not clear (2). We suggest that every hospital has to choose the appropriate antibiotic and its dosage for prophylaxis, according to the bacterial agent and it is also possible to determine the treatment regimen by this kind surveillance studies.

Materials and methods

This research has been carried out between September 2004 and October 2005 at the Department of Microbiology and Clinical Microbiology, Cerrahpaşa Faculty of Medicine, İstanbul University. The presence of bacteriuria was researched in urine samples of pediatric patients who were undergoing urodynamic evaluation at the Cerrahpaşa Faculty of Medicine Videourodynamics Laboratory of the Department of Child Surgery.

Two urine samples were taken and examined microbiologically; the first group of urine samples was collected by catheterization and also catheter specimens of urine samples were obtained in the Videourodynamics Laboratory at the time of testing, and then sent for bacteriological consideration to the microbiology laboratory. The second group of urine samples was collected within 6 days after the procedure from the same patients using the mid-flow method. A prophylaxis treatment was started in 24 h before urodynamic testing using of ampicillin, cefixime, cefuroxime, trimethoprim-sulfamethoxazole, and nitrofurantoin, and continued 48 h after the procedure. At the end of this period the second group of urine samples was taken from patients who had not used any antibiotics at least 4 days prior to the sampling.

After Gram-staining, urine samples were inoculated on MacConcey agar and Chocolate agar, incubated at 37 °C for 24 h. Identification of isolated bacteria were performed by standard clinical laboratory methods and confirmed by Analytical Profile Index (API) (bioMerieux Marcy-L'Etoile, France) commercial kit.

The cultures of urine samples were considered positive if there were at least 10^5 CFU/mL (colony-forming units per milliliter) microorganisms consisting of only 1 or 2 different types of microorganisms. Moreover, pyuria was determined by Gram-staining. All of these samples had pyuria on microscopy indicating the evidence of active infection rather than contamination. Antibiotic susceptibility

tests of pathogenic bacteria were determined by disc diffusion method, according to CLSI criteria.

McNemar's test was used for statistical analysis and comparing the effectiveness of the applied prophylaxis.

Results

Urine samples of 90 (55 female and 35 male with an age range of 0-14 years) patients who were undergoing urodynamic evaluation were examined and results were compared with the applied prophylaxis. Whereas 41% (37 patients) of the patients had urinary incontinence, 30% (27 patients) had anatomic disorders, and 29% (26 patients) had neurogenic bladder symptoms.

The most commonly used (55.5%) prophylactic antibiotic was trimethoprim-sulfamethoxazole (50 patients). Sixteen (32%) patients from this group had positive urine cultures after urodynamics despite the use of trimethoprim-sulfamethoxazole. Six (12%) of them had persistent bacteriuria with the same bacterial growth before and after the urodynamics. Nitrofurantoin had been applied to 17 (18.8%) patients, 9 (52.4%) of them had positive urine cultures and 3 (17.6%) patients from this group had the same bacterial growth before and after the urodynamics. The rate of bacteriuria was found statistically higher ($P < 0.05$) in patients after urodynamics compared to pre-urodynamic data (Table 1).

Nine (10%) of the patients had used cefixime as prophylactic antibiotic. At the time of the procedure, two (22.2%) of them had bacteriuria and the number of bacteriuric group increased to three (33.3%) after the testing. Three (3.3%) patients had used cefuroxime as prophylactic antibiotic. None of them had positive urine cultures before the urodynamics, but 2 of them had bacteriuria after the procedure.

One (1.1%) patient who used ampicillin had a positive urine culture before the procedure and the positivity was continued in the second urine sample with the same bacterial agent. There was no significant difference between the rates of bacteriuria that were determined before and after urodynamics in patients under cephalosporin and ampicillin prophylaxis ($P > 0.05$) (Table 1).

We also used a control group consisted of 10 (11.1%) individuals. Two (20%) of them had persistent bacteriuria with the same organisms before and after the procedure, but the number of patients with bacteriuria who had sterile urine cultures before the testing had raised to 4 (40%) after the urodynamics. There was no significant difference between the rates of bacteriuria determined before and after urodynamics in patients who were not under any prophylaxis ($P > 0.05$) (Table 1).

In total, we detected urine cultures in 36 (40%) out of 90 patients. *E. coli* was the most frequently isolated bacteria (25 patients; 27.7%), 3 of them were ESBL positive strains. The other isolated microorganisms

Table 1. The distribution of patients who had bacteriuria in urine cultures according to the prophylaxis applied before and after the urodynamic evaluation.

Prophylaxis	No of Total patients	Growth in culture		P
		No of Patients Before Urodynamics (%)	No of Patients After Urodynamics (%)	
Ampicillin	1	1 (100%)	1 (100%)	P > 0.05
Cefixime	9	2 (22.2%)	3 (33.3%)	P > 0.05
Cefuroxime	3	0 (%0%)	2 (66.6%)	P > 0.05
Trimethoprim-Sulfamethoxazole	50	6 (12%)	*16 (32%)	P = 0.006
Nitrofurantoin	17	3 (17.6%)	9 (52.4%)	P = 0.031
Prophylaxis not applied	10	2 (20%)	4 (40%)	P > 0.05

* The urine sample of one patient was sterile after the urodynamics.

were *Klebsiella pneumoniae* (5 patients; 5.5%), *Proteus mirabilis* (2 patients; 2.2%), *Pseudomonas aeruginosa* (1 patient), *Candida albicans* (1 patient), *Enterococcus* sp. (5.5%; 4 strains of *E. faecalis*, 1 strain of *E. faecium*), *Staphylococcus* sp. (3.3%; 2 strains of Coagulase negative *Stapylococcus*, 1 strain of *S. aureus*) (Table 2).

In our study, we evaluated 80 patients who were under prophylaxis; 12 of them had bacteriuria at the time of urodynamic testing but the number increased to 32 after the procedure. The acquired bacteriuria rate was detected as 25%. Also in only one patient, the second urine culture was detected negative after 6 days although it was positive in the first one.

Discussion

Shekkariz et al. (13) reported that, 46 patients had bacteriuria and 23 patients had sterile urine at the time of urodynamic testing in total of 69 (mean age 10) pediatric patients. Bergman et al. (4) reported that that the rate of female patients with bacteriuria was 7.3%. In our study 55 female and 35 male patients (age

Table 2. The distribution of bacteria that were isolated before and after the urodynamic evaluation.

BACTERIA	No of Total patients	Grown before UD*	Grown only after UD*
Klebsiella pneumoniae	3	2	1
E. coli	17	6	11
E. cloacae + *E. coli*	1	1	0
Enterococcus spp.	3	2	1
ESBL (+) *E.coli*	2	1	1
C. albicans	1	1	0 * *
P. aeruginosa	1	1	0
E. coli + *Klebsiella* spp.	2	0	2
Enterococcus spp + CN *Staphylococcus* spp.	1	0	1
Enterococcus spp. + ESBL (+) *E. coli*	1	0	1
P. mirabilis	2	0	2
MRCN *Staphylococcus* spp.	1	0	1
MSSA + *E. coli*	1	0	1
Total patients	36	14	22

*UD: Urodynamics
** In the second urine culture *E. coli* was isolated with *C. albicans*.
MRCN: Meticilline resistant Coagulase negative
MSSA: Meticilline sensitive *Staphylococcus aureus*
ESBL: Extended spectrum beta lactamase

range: 0-14) who were undergoing urodynamic evaluation were examined.

As stated in the previous studies, trimethoprim-sulfamethoxazole and nitrofurantoin were the most commonly applied prophylactic antimicrobial agents and beta lactam antibiotics were rarely used (14-16). We investigated the effectiveness of trimethoprim-sulfamethoxazole in 50 and nitrofurantoin in 17 patients according to the references.

The period of antibiotic usage differs in different hospitals. In our study prophylaxis started 24 h before and continued 48 h after the urodynamic testing.

E. coli was shown to be the most commonly isolated pathogen before the urodynamic testing. Shekarriz et al. reported that *E. coli* was isolated from 38% of the total urine samples (13). Bergman and McCarthy (4) reported that 3 out of 45 female patients had positive cultures at the time of urodynamic testing and the isolated pathogen was *E. coli* in all of them.

Okorocha et al. reported that 12 (10.3%) out of 117 patients had asymptomatic bacteriuria. Coliforms were isolated in the cultures of all patients with bacteriuria and in 2 of them *Enterococcus* sp was also isolated (18). Ninety patients were evaluated in our study and 14 (15.5%) of them had unsuspected bacteriuria. In our study *E. coli* was isolated from urine samples in 8 (57%) patients, which is in agreement with the results of Okorocha et al.

In the previous studies; presence of *Klebsiella pneumoniae*, *Candida albicans*, *Enterococcus* sp., *Staphylococcus* sp., and *Enterobacter cloace* were reported as the causative bacterial agents in the patients with bacteriuria at the time of urodynamics (4,13,18). In our study, *Staphylococcus* sp. was not isolated in the samples collected before the procedure. Contrary to our results, *Staphylococcus* sp. growth was also reported in some studies (13). Moreover, we want to emphasize the growth of one *Pseudomonas aeruginosa* and one ESBL positive *E. coli* isolates which were thought that patients may contact with nosocomial infectious agents before the urodynamic testing.

Okorocha et al. (17) reported that, 19 (19.6%) out of 97 patients who had sterile urine cultures had bacteriuria afterwards. Bergman and McCarthy (4) showed that bacteriuria has developed in 4 of the 51 patients who received antibiotic prophylaxis, but all cultures were sterile 1 week after the examination. In Quek and Tay's study, a significant rate of 13.9% bacteriuria development in post-urodynamics without antibiotic prophylaxis was observed (18).

In our study, in 12 of 80 patients who received prophylaxis, the presence of unsuspected bacteriuria was demonstrated. The number of bacteriuria group increased to 32 (25%) after the urodynamic testing. These results are found higher when compared with other similar studies (4,17,18).

Another significant point of our study is the isolation of some nosocomial infection agents. ESBL + *E. coli* and *E. faecium* isolated from patients under prophylaxis showed the importance of this kind of surveillance studies. It has been shown that all of the agents were mostly resistant to trimethoprim-sulfamethoxazole and nitrofurantoin. In these circumstances it appears that choosing prophylactic antibiotics are not easy to decide. It might be thought that use of prophylactic antibiotic can reduce the colonization rates of nosocomial agents. We think that more studies are needed to determine which antibiotic prophylaxis will be effective for urodynamic testing.

Acknowlegement

We thank Hrisi Bahar for critical reading of the manuscript and supporting in laboratory experiments, and Yunus Söylet, Haluk Emir, and Necla Ünalmış for providing urine samples and required clinical information.

Funding for this research was provided by The Research Support Unit of İstanbul University. Project Number: T-809/27122005

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