

The need for antibiotic prophylaxis before urodynamic studies

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Aim: The use of antibiotic prophylaxis before urodynamic studies (US) is not recommended routinely. We investigated the factors that would enable us to predict bacteriuria that is likely to develop after US, and that make us consider the need for prophylaxis.

Materials and methods: One hundred and four patients who would undergo US with a suspicion of lower urinary tract dysfunction were enrolled in the present study and followed up prospectively. The relationship between bacteriuria and several parameters, such as gender, age, body mass index, glomerular filtration rates, systemic diseases, urinary flow rates, residual urine volume, the type of process performed, and maximum cystometric capacity values, was investigated.

Results: Following US, a bacteria level of 105 was detected in 7 of 104 patients (6.7%). According to the results of the Pearson's chi square test, there was a statistically significant relationship only between the presence of diabetes and bacteriuria ($P = 0.013$). Logistic regression analysis revealed statistically significant results indicating a direct proportion between the incidence of bacteriuria and increased post-void residual volume ($P < 0.0001$), with an inverse proportion between the frequency of bacteriuria and decreased bladder capacity ($P = 0.021$).

Conclusion: Due to low rates of bacteriuria after US, the use of prophylactic antibiotics is not a routine procedure except in selected patients.

Key words: Urodynamics, bacteriuria, infection, prophylaxis

Ürodinamik çalışmalar öncesi antibiyotik profilaksisi gerekliliği

Amaç: Ürodinamik incelemeler (Uİ) öncesi antibiyotik profilaksisi, rutin önerilen bir uygulama değildir. Bu prospektif çalışmada Uİ sonrasında gelişebilecek bakteriyüriyi önceden tahmin etmemizi sağlayıp bu şekilde profilaksi gerekliliğini düşündürecek faktörler araştırıldı.

Yöntem ve gereç: Çalışmaya alt üriner sistem disfonksiyonu kuşkusuyla ürodinami uygulanacak 104 hasta dahil edildi ve prospektif olarak takip edildiler. Hastaların cinsiyetleri, yaşları, vücut-kitle oranları, glomeruler filtrasyon hızları, sistemik hastalıkları (diabetes mellitus, kronik böbrek yetmezliği, nörolojik hastalıklar), maksimum idrar akım hızları, işeme sonrası rezidu idrar volumleri, uygulanan işlemin cinsi (dolum sistometrisi veya basınç akım çalışması), maksimum sistometrik kapasite değerlerinin bakteriyüriyle ilişkileri araştırıldı.

Bulgular: Uİ sonrasında 104 hastanın 72'sinin idrarında (% 6,7) 105 ve daha fazla bakteri saptandı. Yapılan Pearson ki-kare test sonuçlarına göre sadece diabet varlığı ile bakteriyüri arasında anlamlı ilişki saptandı ($P = 0,013$). Logistic regresyon analizinde ürodinami sonrası bakteriyüri sıklığı ile işeme sonrası rezidue volum artışı ($P < 0,0001$) arasında doğru orantılı, azalmış mesane kapasitesiyle ($P = 0,021$) ise ters orantılı anlamlı sonuçlar elde edilmiştir. Yine aynı metot ile diğer parametrelerin araştırılmasında sadece diabetes mellitus ile bakteriyüri arasında anlamlı ilişki izlendi ($P = 0,001$).

Sonuç: Uİ sonrası görülen bakteriyüri ve üriner sistem enfeksiyonları oranlarının düşüklüğü nedeniyle profilaktik antibiyotik kullanımı seçilmiş hastalar dışında rutin uygulanması gerekli bir prosedür değildir.

Anahtar sözcükler: Ürodinami, bakteriyüri, enfeksiyon, profilaksi

Received: 03.07.2010 – Accepted: 03.10.2010

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Introduction

Urodynamic studies (US) are commonly used in evaluation of lower urinary tract functions. In the current literature, no mortality has been reported and rates of morbidity are considerably low following US. The most common complication is urinary tract infection (UTI), which occurs after the process (1-3). The incidence of bacteriuria was reported to range from 1% to 30% after US (1-7). Although symptomatic UTI is not observed in every patient following bacteriuria, it should be taken into consideration in patients with lower urinary tract dysfunction because asymptomatic bacteriuria may easily become symptomatic and even complicated UTI in these patients. In the present prospective study, we investigated the factors that would enable us predict bacteriuria that is likely to develop after US, and that make us consider the need for prophylaxis.

Materials and methods

The patients in whom US were planned with the suspicion of lower urinary tract dysfunction in urology clinic were enrolled in the present study and investigated prospectively. The patients whose mid-stream urine samples revealed a bacteria level of $\geq 10^5$ before the process, those who perform clean intermittent catheterization, and those who need prophylaxis due to cardiac diseases or their prostheses were excluded and a total of 104 patients were included in the present study. In none of the patients was prophylactic antibiotherapy administered.

Firstly, post-void residual volumes were measured by free uroflowmetry and Bladder Scan[®] (BVI 6100, Verathon Inc., Bothel, WA, USA). Prior to the catheterization, urethral meatus, together with vulva of females and glans penis of males were cleaned with polyvidone iodine solution. US (filling cystometry or pressure flow study) were performed after the 8 Fr, single use, sterile, double lumen catheter was inserted using sterile lubricant. A sterile saline solution was used during the process; catheters and connectors were disposable and replaced after each patient use. Water-charged system and a urodynamics device from Medical Measurement Systems (MMS, Enschede, The Netherlands) were used for urodynamic studies. Two weeks after US, mid-

stream urine samples from all patients underwent culture and antibiogram examination. We decided on a 2-week waiting period to prevent confusion of temporary edema and irritative symptoms with UTI symptoms, which may develop in patients after catheterization. However, each patient was asked to contact one of the authors in case of severe symptoms of complicated or uncomplicated UTI before the end of the waiting period. The patients with a bacteria level of $\geq 10^5$ were considered as positive. The association between bacteriuria and several parameters, such as gender, age, body mass index (BMI), glomerular filtration rates, systemic diseases (diabetes mellitus, chronic renal failure, neurological diseases), maximum urinary flow rates, post-void residual urine volume (PVRV), the type of process applied (filling cystometry or pressure flow study), and maximum cystometric capacity values, was investigated. SPSS version 15 was used for statistical analysis. Additionally, multiple logistic regression analysis, Pearson's chi-square test, and Roc analysis for continuous variables were used for statistical analysis.

Results

Of the 104 patients enrolled in the study, 57 were female and 47 were male. Demographic data are shown in Table 1. Wet overactive bladder symptoms were present in 62 of these patients, dry overactive bladder symptoms in 20, and lower urinary tract symptoms in 22, which thus necessitated US. It was observed that the mean age of the patients was 48.9 (12-78) years and the mean BMI was 20.05 (17.8-38.6). A bacteria level of $\geq 10^5$ was detected in 7 (6.7%) of 104 patients, whose mid-stream urinary flow samples were investigated 2 weeks after US. Urodynamic examination of the 7 patients revealed findings of detrusor overactivity in 5 patients, and atonic detrusor and infravesical obstruction in 1 patient each. None of the patients received any antibiotics during this period. Symptoms of uncomplicated UTI were observed in 4 of 7 patients whereas the remaining 3 were asymptomatic. *Escherichia coli* was isolated from 5 patients and *Klebsiella pneumoniae* from 2 patients. According to the results of Pearson's chi square test, there was a statistically significant relationship only between the presence of diabetes

Table 1. Demographic data.

Parameter	Number (n)
Patient	
Female	57
Male	47
Age	48.9(12-78)
BMI*	20.05(17.8-38.6)
Co-morbid	diseases
Diabetes mellitus	9
Neurologic diseases	11
CRF**	28
Urodynamic examination	
Filling cystometry	74
Filling-voiding cystometry	30

*Body-mass index

**Chronic renal failure

and bacteriuria ($P = 0.013$). Logistic regression analysis revealed statistically significant results indicating a direct proportion between the incidence of bacteriuria and increased PVRV ($P < 0.0001$), with an inverse proportion between the incidence of bacteriuria and decreased bladder capacity ($P = 0.021$). When the other parameters were analyzed using the same method, a statistically significant relationship was detected only between diabetes mellitus and bacteriuria ($P = 0.001$). Subsequently, Roc analysis was used to evaluate continuous variables in groups whose results were found to be statistically significant using logistic regression analysis. Accordingly, the cut-off value for PVRV was observed to be 100 mL (area under the curve 0.959) and the cut-off value for bladder capacity was 280 mL (area under the curve 0.756). We found that the incidence of bacteriuria was significantly increased after US in patients with a PVRV volume of greater than 100 mL and those with a bladder capacity of less than 280 mL.

No significant relationship was observed between bacteriuria and the patient's gender, age, BMI, urinary flow rates, the type of process applied, chronic renal failure, and neurological diseases developed following US (Table 2).

Discussion

Rates of bacteriuria following US have been observed to be quite low. Therefore, prophylaxis is not routinely used to prevent UTI or bacteriuria, which is likely to develop after US except in patients who have cardiac valve abnormalities or a pacemaker or those in whom orthopedic or genitourinary prostheses were implanted (8). Because the risk of infection ranges between 1% and 5% when a catheter is advanced into the bladder through the urethra and then removed (9-11), it should be acknowledged that a bacteriuria rate of 6.7% is very low. Studies in the literature suggest that it is extremely difficult to predict bacteriuria after US (1,12,13). However, in the present study, of the 104 patients, we identified factors that would enable us to predict bacteriuria that is likely to occur after US.

Poorly emptying bladder and increased PVRV are known to increase the risk of UTI. In a study by Bombieri et al., no statistically significant result was found between maximum flow rates and rates of infection, which is in agreement with the results of our study (1). However, there are limited data in the literature regarding residual urine studies combined with uroflowmetry before US. In the present study, we found that the incidence of bacteriuria was significantly increased in patients whose PVRV was found to be greater than 100 mL after performing uroflowmetry and a PVRV measurement before each US and evaluating the resulting parameters. Mucosal polysaccharides (glycosaminoglycan) are important defense mechanisms that prevent adhering of bacteria to uroepithelial cells. Residual urine in the bladder particularly impairs this mechanism, contributing to the development of UTI (14-16). It is apparent that the development of infection after urodynamics is more likely in patients with risk factors for UTI. It is a well-known fact that bacteria carried by the catheter, in an ascending manner, would easily lead to infection in impaired mucosal defense system due to low urinary tract dysfunction (particularly due to increased PVRV).

In the present study it was also found that as the bladder capacity decreased, the incidence of bacteriuria increased. One of the most important causes of decreased bladder capacity is developing

Table 2. The analysis of variables using Pearson chi-square test.

	Bacteriuria after invasive urodynamics		
	No (%)	Yes (%)	P
Post-voiding residue urine			
≤100 mL*	86 (100)	0	
>100 mL	11 (61.1)	7 (38.9)	<0.00001
Bladder capacity			
≤280 mL*	55 (90.2)	6 (9.8)	
>280 mL	42 (97.7)	1 (2.3)	0.021
Diabetes mellitus			
Yes	6 (66.7)	3 (33.3)	
No	91 (95.8)	4 (4.2)	0.013
Multiple sclerosis			
Yes	5(83.4)	1(16.6)	
No	92(93.9)	6(6.1)	0.229
Parkinson's disease			
Yes	4(80)	1(20)	
No	93(93.9)	6(6.1)	0.092
Chronic renal failure**			
Yes	25(89.3)	3(10.7)	
No	72(94.7)	4(5.3)	0.426

* Values were established using Roc analysis

** In accordance with criteria established by National Kidney Foundation (NKF-KDOQI) in 2002, CRF is defined as a decreased glomerular filtration rate (GFR) of less than 60 mL/min per 1.73 m².

fibrosis in adults. The relationship between infection and increased incidence of vesicoureteral reflux associated with fibrosis in the bladder has long been known. We cannot speculate about the presence of reflux since video urodynamics was not performed in patients included in this study. Thus, we hypothesize that the causes of the relationship between decreased bladder capacity and accordingly increased incidence of bacteriuria are probably reflux and decreased mucosal defense mechanisms.

The risk of UTI in diabetic patients is 10 times more than that in the normal population (17). Hyperglycemia and diabetes are important factors that impair neutrophil functions and facilitate the development of infection (18). Additionally, increased residual urine volume due to autonomic neuropathy, which is common in diabetic patients, is another remarkable factor predisposing to infections. In the present study, the incidence of bacteriuria was observed to be considerably high with a rate of 33%. As a result of our study, we agree with Yenilmez et al.

that prophylaxis should absolutely be administered before US to prevent infection, which is likely to occur after US, from spreading quickly and becoming complicated in diabetic patients (19).

Conclusion

Due to low incidence rates of bacteriuria and UTI after US, the use of prophylactic antibiotics is not a routine procedure except in selected patients. Depending on the data obtained in this study, we recommend the administration of prophylaxis before US in patients with diabetes mellitus. However, we think that in order to reduce incidences of bacteriuria and UTI it would be beneficial to administer prophylaxis in patients whose PVRV value was found to be greater than 100 mL and the total of PVRV and voiding urine volume (the bladder capacity) less than 280 mL after performing uroflowmetry and residual urinary volume measurements, which are requisite before US.

References

1. Bombieri L, Dance DA, Rienhart GW, Waterfield A, Freeman RM. Urinary tract infection after urodynamic studies in women: incidence and natural history. *BJU Int* 1999; 83: 392-5.
2. Okorochoa I, Cumming G, Gould I. Female urodynamics and lower urinary tract infection. *BJU Int* 2002; 89: 863-7.
3. Almallah YZ, Rennie CD, Stone J, Lancashire MJ. Urinary tract infection and patient satisfaction after flexible cystoscopy and urodynamic evaluation. *Urology* 2000; 56: 37-9.
4. Sabanathan K, Duffin HM, Castleden CM. Urinary tract infection after cystometry. *Age Ageing* 1985; 14: 291-5.
5. Klingler HC, Madersbacher S, Djavan B, Schatzl G, Marberger M, Schmidbauer CP. Morbidity of the evaluation of the lower urinary tract with transurethral multichannel pressure-flow studies. *J Urol* 1998; 159: 191-4.
6. Porru D, Madeddu G, Campus G, Montisci I, Scarpa RM, Usai E. Evaluation of morbidity of multi-channel pressure-flow studies. *Neurourol Urodyn* 1999; 18: 647-52.
7. Carter PG, Lewis P, Abrams P. Urodynamic morbidity and dysuria prophylaxis. *Br J Urol* 1991; 67: 40-1.
8. Webster GD. Basic Urodynamics Course 2007. American Urological Association Annual Meeting, Anaheim, CA, USA.
9. Warren JW. Catheter-associated urinary tract infections. *Int J Antimicrob Agents* 2001; 17: 299-303.
10. Sedor J, Mulholland SG. Hospital-acquired urinary tract infections associated with the indwelling catheter. *Urol Clin of North Am* 1999; 26: 821-8.
11. Warren J, Bakke A, Desgranchamps F, Johnson JR, Kumon H, Shah J et al. Catheter associated bacteriuria and the role of biomaterial in prevention. In: Naber KG, Pechere JC, Kumazawa J, Khoury S, Gerberding IL, Schaeffer AJ, eds. Nosocomial and health care associated infections in urology. Plymouth: Health Publications Ltd 2001; pp. 153-176.
12. Siracusano S, Knez R, Tiberio A, Alfano V, Giannantoni A, Pappagallo G. The usefulness of antibiotic prophylaxis in invasive urodynamics in postmenopausal female subjects. *Int Urogynecol J* 2008; 19: 939-42.
13. Tong AVM, Cheon WC. Urinary tract infection after urodynamic study in women. *HKJGOM* 2005; 5: 22-5.
14. Beylot M, Marion D, Noel G. Ultrasonographic determination of residual urine in diabetic subjects: relationship to neuropathy and urinary tract infection *Diabetes Care* 1982; 5: 501-5.
15. Tan TL, Lieu PK, Ding YY Urinary retention in hospitalised older women. *Ann Acad Med Singapore* 2001; 30: 588-92.
16. Sobel JD. Pathogenesis of urinary tract infection; role of host defenses. *Infect Dis Clin North Am* 1997; 11: 531-49.
17. Goswami R, Bal CS, Tejaswi S. Prevalence of urinary tract infection and renal scars in patients with diabetes mellitus. *Diabetes Res Clin Pract* 2001; 53: 181-6.
18. Bartelink ML, Hoek L, Freriks JP, Rutten GE. Infections in patients with type 2 diabetes in general practice. *Diabetes Res Clin Pract* 1998; 40: 15-9.
19. Yenilmez A, Kebapci N, Isikli B, Hamarat M, Donmez T. Morbidity after urodynamic study in diabetic patients. *Acta Diabetol* 2009; 49: 197-202.