



# Moderate and Timely Water Intake Followed By Micturition Reduces Frequency of Recurrent Urinary Tract Infections and the Prevalence of Virulent Uropathogens in Adult Women

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## Abstract

Urinary tract infection (UTI) is the most common type of infection in women. Preventive measures included local hygiene, clothing, diet, limiting activities, and prophylactic antibiotics. In this study; we evaluated the role of a simple technique of 5-timely oral water flushing of the urinary bladder in its prevention. The technique entailed an intake of 250 ml of plain water followed by micturition 15-30 minute later at; early morning, 30 minute after the 3 daily meals and 1 hour before night sleep. Moreover, married women had an additional similar bolus intake 30 minute before sexual intercourse and micturition immediately after coitus. This prophylactic regimen has been evaluated in 422 adult non-menopausal females with high-rate of recurrent UTI (>2 UTI/year) for a median duration of 33 months. Married women; had higher rate of UTI/patient year and incidence of non-E coli bacteriuria compared to non-married ones. Our prophylactic technique resulted in; (a) decrease in UTI rate/patient year on follow up from 2.3(0.8) to 0(0.3), (b) clearance of bacteriuria in 69% of women, and decrease of non-E coli pathogens from 31% to 2% (p< 0.001). The latter was due to limiting the use of antibiotics. Married women had similar encouraging results. In conclusion; moderate and timely water intake followed by micturition reduces frequency of recurrent urinary tract infections and the prevalence of virulent uropathogens in adult women.

**Keywords:** adults, infection, prophylaxis, water, women, urinary tract

## Introduction

In the United States, urinary tract infections (UTI) account for nearly seven million office visits, a million emergency department visits, and one hundred thousand hospitalizations every year <sup>[1]</sup>. The cost of UTI is significant both in terms of time-lost at work and costs of medical care. In the United States the direct cost of treatment is 1.6 billion USD/year <sup>[2]</sup>. Most UTIs, in women, are ascending infections of bacteria that colonize the vaginal wall then enter the urinary bladder via the urethra. Due to short urethra; UTI is common in women. It varies with age, sex, sexual activity, and the presence of genitourinary abnormalities. The prevalence of community acquired and asymptomatic bacteriuria in adult women without co-morbid conditions is 1-5% and 9-27% in diabetics and 25-50% in in nursing homes <sup>[3]</sup>. E coli is the commonest uropathogen and accounts for 75-95% in asymptomatic bacteria and 50% of cases of urosepsis <sup>[4]</sup>. To avoid antibiotic resistance; asymptomatic bacteriuria rarely needs treatment except in pregnant

women, recent kidney transplants, children with vesicoureteric reflux disease and those undergoing surgery of the urinary tract <sup>[5]</sup>. On the other hand, nearly 25% of sepsis cases originates from urogenital tract and has a mortality rate up to 35% <sup>[4]</sup>. Untreated symptomatic and recurrent bacteriuria can progress to urosepsis leading to respiratory distress syndrome, kidney injury and disseminated intravascular coagulopathy <sup>[5]</sup>. Over the last few decades, there has been an increase in multi-drug resistant organisms causing UTIs, making treatment more complicated. It stemmed from the overuse of antibiotics to treat suspected UTI. It has been advocated as a single dose after coitus, when symptoms and lastly as a low-dose for 6 months <sup>[6]</sup>. In this study; we evaluated the role of a simple technique of timed oral water flushing of the urinary bladder in its prevention and to avoid emergence of resistant uropathogens.

## Patients and methods

The study was conducted by the renal unit of Al-Amiri hospital. The unit is a referral center for patients with renal disease in 2 major hospitals in the capital of Kuwait city and is a tertiary care unit for the other hospitals in Kuwait. It has adequate diagnostic as well as therapeutic facilities to care for both in- and out-patients with all medical and renal diseases. Adult women with symptomatic and recurrent UTI from 1<sup>st</sup> January 2016 to 31st December 2019 were analyzed prospectively. Patients were included in the study if they were adult women with symptomatic and recurrent bacterial UT (> 2/year over 2 previous years). Diagnosis of UTI was established by finding significant pyuria and bacteriuria in a 2 consecutive clean-catch mid-stream urine collection. Significant pyuria was defined as > 5 white blood cells/HPF and bacteriuria as > 105 colony-forming units (cfu) per mL [7].

**Exclusion criteria:**

Patients were excluded if they (a) were menopausal or younger than 14 years, (b) had urinary tract anomalies viz. obstruction, medullary sponge kidneys, autosomal dominant polycystic kidneys, vesicoureteric reflux disease and cysto/urethrocele, (c) had persistent foreign bodies viz. stones, indwelling urinary catheters and stents, (d) had recurrent papillary necrosis, (e) had sterile pyuria or mycobacteria (f) had kidney transplants, (g) were bed-redden (h) had creatinine clearance < 60 ml/minute, (i) require maintenance drugs with anticholinergic side effects, and (j) psychiatric patients.

**Technique of oral-water prophylaxis:**

It entailed an intake of 250 ml of plain water followed by micturition 15-30 minute later at; early morning, 30 minute after the 3 daily meals and 1 hour before night sleep. Moreover, married women had an additional similar water bolus 30 minute before sexual intercourse followed by micturition immediately after coitus.

**Initial assessment:**

Included laboratory and radiological testing. The laboratory ones included renal profile, 24 hour urine collections for creatinine clearance, and mid-stream urine collections for microscopic examination for pyuria and urine culture for significant bacteriuria. Radiological tests included; abdominal and pelvic ultrasound as well as CT scan of the abdomen and pelvis with/without contrast and nuclear scans (DMSA and MAG III) when indicated.

**Follow up testing:**

Included renal profile and mid-stream urine microscopy as well as urine culture and antibiotic susceptibility testing every 2 months or if symptomatic UTI.

**Statistical analysis:**

SPSS statistical package version 25 was used for data entry and processing. The p-value <0.05 was used as the cut-off level for significance. Since the age, duration of UTI prior to water prophylaxis and duration of follow up were not normally distributed; the median and (Interquartile Range) were used to express the groups. To compare married and unmarried groups Mann-Whitney U test was used and prior with subsequent results Wilcoxon Signed Rank test was used.

**Results**

Over the past 5 years, a total of 1348 patients were screened for the study. However, only 431 patients satisfied the inclusion criteria. Moreover, during follow up, 9 patients lacked compliance with water prophylaxis and hence were excluded from analysis. Demographical data on the 422 patients and results of the study are summarized in table 1. All patients were adult women with a median age 39 (15) years. The median duration of previous recurrent UTI was 20 (5) months. Follow up for the efficacy of water prophylaxis was for 33 (5) months. Prior rate of UTI was 2.3 (0.8)/patient year.

**Table 1: Demographical data and response of recurrent UTI to water prophylaxis in different subgroups**

Patients	Marital status		Total
	Married 337	Unmarried 85	
Age (years)	39(7) *	19(4) *	39(15)
Duration of UTI:	20(6)	20(4)	20(5)
Duration of follow up:	33(5)	33(4)	33(5)
<u>Prior:</u>			
Rate of UTI/patient year:	2.4(0.9) * Ω	2(0.6) * Ω	2.3(0.8) Ω
Type of UTI: n(%)			
E coli	222(65%) * +	70(82%) * +	292(69%)
Non-E coli	115(34%) * +	15(18%) * +	130(31%) +
<u>Subsequent:</u>			
Rate of UTI/patient year:	0(0.3) Ω	0(0) Ω	0(0.3) Ω
Type of UTI: n(%)			
No bacteriuria	213(63%) *	77(91%) *	290(69%)
E coli	114(34%) * +	8(9%) * +	122(29%) +
Non-E coli	10(3%) * +	0(0%)* +	10(2%) +

Abbreviation: urinary tract infection: UTI

Significant difference (p:<0.001): (\*) married & unmarried, (Ω): prior and subsequent rates, (+): type of bacteria prior & subsequent

### Demographical data in unmarried and married women:

Both groups had similar duration of previous UTI and follow up at 20 and 33 months, respectively. Married women were older with a median age at 39 (7) years compared to married ones at 19 (4). The rate of UTI/patient was higher in the married group compared to unmarried ones: 4.2/patient and 3.6/patient, respectively. Moreover, they had higher prevalence of non-E coli bacteria at 34% compared to 18% in unmarried ones.

### Efficacy of prophylaxis:

All patients had improvement in the rate of subsequent UTI with decrease in rate of UTI from 2.3 (0.8)/patient year to 0(0.3)/patient year with 69% without subsequent UTI after a median of 33 months of follow up. At the end of follow up; 91% unmarried women and 63% married ones were UTI-free. Moreover, in those who had subsequent UTI, the prevalence of non-E coli organisms had decreased from 18% to 0% and in married ones had decreased from 34% to 3%.

## Discussion

Despite lack of co-morbid conditions; adult women are at 10 times higher risk for UTI compared to men due to; (a) shorter urethra, (b) proximity to anus, (c) lack of antibactericidal prostatic secretions, and (d) facilitation of bacterial migration by sexual intercourse [1]. In this patient population multiple preventive measures have been used viz. local hygiene during menses without local use of deodorants or antiseptics, wiping from front to back after bowel movements to avoid contamination with gut bacteria, the use loose cotton underwear to avoid moisture, the use of water soluble lubricant during sex and avoidance of spermicide condoms and anal sex, cranberry juice and excessive water intake [7]. The benefit of cranberry juice or tablets was attributed to its content of proanthocyanidins which seemed to prevent E. coli adhesion to the walls of the digestive and urinary tract [8]. Unfortunately, the latter could not be confirmed in subsequent randomized controlled studies [9]. Moreover, its acidity limits its long-term acceptance in addition to its high content of oxalate predisposing to calcium oxalate urolithiasis and its interaction with Warfarin with potential for over anticoagulation and bleeding risks. On the other hand; the National Health Service (NHS) recommends 'drinking plenty of fluids', as it helps to 'flush out' the bacteria and prevents UTI. However, evidence is limited to support this recommendation except for a prospective study in 2018 [10]. In the latter; 3 negative issues were evident; (a) no range was recommended for the increase in water intake except for > 1.5 liter/day, (b) patients' follow up was done via monthly telephone calls, (c) short follow up at 12 months only. In our study, and to avoid future UTI, we specified a timely and tolerable amount of water flushes of the urinary bladder. The distribution of the 5 relatively small water-boluses was to cover the whole day with the last one before night sleep by 1 hour to avoid nocturia. The results of the study showed significant prevention of UTI without specific alterations in diet, clothing, exercise, cranberry preparations and antibiotics. The idea was to practice a practical and affordable mean of prophylaxis. In our patients; the avoidance of frequent antibiotic use for recurrent UTI or prophylaxis resulted in low incidence of non-E coli

pathogens. In our study, and compared to unmarried women, married ones had higher rate of UTI and prevalence of more resistant non-E coli bacteria. The 2 observations reflect the negative association of coitus and UTI and the higher subsequent antibiotic treatments. Hence, we elected to test the efficacy of a specific additional bolus 30 minutes before coitus and urination immediately after it. Again, the latter regimen proved to be tolerable and efficacious. Our study confirmed the beneficial role of water prophylaxis in adult women with recurrent UTI that lacks co-morbid conditions. The efficacy was not tested in children, post-menopausal women, men, those with co-morbid systemic diseases, immobilized patients, those with indwelling urinary catheters and those with urinary tract anomalies. Such regimen may add additional aids in their management but future studies are needed. In conclusion; moderate and timed water intake followed by micturition reduces frequency of recurrent urinary tract infections and the prevalence of virulent uropathogens in adult women.

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