Urinary Tract Infections in College and Non-College Women from Colombia

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Objective: To compare college and non-college women in terms of the frequency of, etiology of, and risk factors associated with urinary tract infections.

Methods: This was a cross-sectional study conducted in Cartagena, Colombia, with 258 female college students and 256 female non-college students from 15 to 34 years old. The participants were interviewed and completed a questionnaire assessing the risk factors associated with urinary tract infections. Urine samples were examined by urinalysis and to look for signs of urinary tract infection, when found, were confirmed by culture. Isolated bacteria were tested for antimicrobial susceptibility using the Kirby–Bauer test. A chi-square test and binary logistic regression were used to analyze the data.

Results: Urinary tract infections were found in 7.8% of the participating college women and 9.4% of the participating non-college women. E. coli was the most frequent uropathogen found in the members of the 2 groups. The majority of the isolated bacteria were highly resistant to β-lactams. Binary logistic regression analysis showed that in the college women, the predictor variables of having a urinary tract infection were the presence of nitrites, leucocytes, and urinary urgency. In the case of the non-college women, the predictor variables were the presence of nitrites and cystitis in the last 2 years.

Conclusion: The frequencies of urinary tract infection were similar in both groups. These individuals might have been taking non-prescribed antibiotics or failing to comply with a prescribed treatment or bacteria are of hospital origin. [*P R Health Sci J 2019;38:97-101*]

Key words: Urinary tract infections, Women, Bacteria, Drug resistance, Microbial, Risk factors

Urinary tract infections (UTIs) are more common among sexually active women than they are among women who are not sexually active (1).

It is estimated that about 35% of healthy women suffer symptoms of a UTI at some time in their lives (2).

UTIs are reportedly the most common bacterial infections in women and account for significant morbidity and increases in the cost of healthcare.

UTIs can affect the quality of life of women and, if not treated, can lead to pyelonephritis (3). In college women there is a high incidence of uncomplicated UTIs; they are frequently treated empirically, which may produce antibiotic resistance that goes undetected (4).

From 75 to 90% of UTIs in women are related to such risk factors as being sexually active, having a history of UTIs, having a family history of UTIs, personal hygiene practices, and contraceptive practices. UTIs are mostly caused by *Enterobacteriaceae*, in particular, *Escherichia coli (E. coli)* (5).

Different studies have evaluated the epidemiological behavior of UTIs in hospitals and laboratories (1,6). However, investigations have still not been done into UTIs in college and non-college women, which investigations would allow the development of strategies for the improvement of their life conditions.

In Colombia there are no studies determining the frequency of UTIs in college women, in spite of the fact that they are considered an at-risk group. This lack can be addressed by exploring UTIs in both college and non-college women in Cartagena, Colombia, and comparing frequencies, risk factors, etiologies, and susceptibility profiles, all to better understand the epidemiological behavior of this infection in these populations.

Material and Methods

This was a cross-sectional study conducted in Cartagena, Colombia, with 258 female college students and 256 female non-college students. Subjects were eligible for inclusion in the study if they were women from 15 to 34 years old. All the subjects gave written informed consent. The sample size was calculated using the prevalences of 41% and 60% for female college students and female non-college students, respectively (3,7).

The participants were interviewed and completed a questionnaire assessing the risk factors associated with UTIs. The participating women were instructed on how to collect a clean, mid-stream urine sample. Women with or without symptoms suggestive of a UTI were included in this study.

Urine samples were examined by urinalysis to look for signs of a UTI, and, when present, the infection was confirmed by culture. A woman was considered to have a UTI if she had 105 cfu per milliliter or more of a uropathogen in a single sample of mid-stream–collected urine.

Isolated bacteria were tested for antimicrobial susceptibility using the Kirby–Bauer test (8).

A statistical analysis of the results was performed using the statistical package SPSS for Windows, version 19. Univariate analysis was done using the chi-square test. We considered a p-value less than 0.05 to be statistically significant. Logistic regression was used to estimate the strength of the association between variables.

This study was approved by the ethics committee of Rafael Núñez University Corporation.

Results

A total of 514 women were enrolled in this study. The average age of the sample was 20.5 ($\pm$ 2.9) years.

The results of the urinalyses indicated that 17.4% and 22.3% of the samples in the college women and non-college women, respectively, were presumably infected (positive for bacteriuria). Samples which were positive for bacteriuria were cultured. Urine cultures confirmed UTIs in 7.8% of the participating college women and 9.4% of the participating non-college women.

In our study, the majority of the women with UTIs were from 15 to 24 years old. The urinalysis results (Table 1) were evaluated with regard to the urine culture. A statistical association was found between leukocytes and nitrites in the urine cultures of both groups (p<0.05).

The frequencies of risk factors were similar in the groups (Table 1). Of the college women, 63.2% answered that they had had cystitis in the last 2 years. Cystitis was associated with sexual intercourse (48/258, 18.6%), menstruation (51/258, 19.8%), and constipation (32/258, 12.4%), among others (dates not shown in the tables). We found a statistical association between having a urine culture positive with cystitis in the last 2 years, having been hospitalized in the last 3 months, and experiencing urinary urgency (p<0.05).

Of the non-college women, 92.6% had used some form of birth control, such as condoms (20.3%); 55.5% of these women reported having had cystitis in the last 2 years, and cystitis was found to be related to sexual intercourse (71/256, 27.7%), menstruation (54/256, 21.1%), and constipation (44/256, 17.2%), among others (dates not shown in the tables). Having a positive urine culture was associated with having had cystitis in the last 2 years and with having used antibiotics no more than 1 week earlier (p<0.05).

Binary logistic regression analysis showed that for the college women, the predictor variables associated with a positive urine culture were nitrites, leucocytes, and urinary urgency. In the case of non-college women, the predictor variables were the presence of nitrites and cystitis in the last 2 years. A Hosmer–Lemeshow goodness-of-fit test indicated a good adjustment between the expected and the observed results, according to the model variables (Table 2).

In this study, the isolates in the college women and non-college women were identified as *Escherichia coli* (9 and 16), *Klebsiella pneumoniae* (7 and 5), *Enterococcus faecalis* (5 and 2), and *Staphlococcus aureus* (2 and 1). The majority of the isolated bacteria were highly resistant to β-lactams. (Table 3). Four multiresistant *E. coli* (resistance to more than 3 antibiotics) were detected in the non-college women, and there was 1 ESBL-producing strain. In the college women, only 1 strain of *K. pneumoniae* was found to be multiresistant.

Discussion

In this study, the frequencies of UTI were similar in both groups. This finding is in agreement with that of Das et al (9), who reported a UTI incidence of 10.83%. Higher frequencies have been reported by other authors (10,11).

Our study showed that there was a high prevalence of UTI in the 15- to 24-year-old women who participated. This result is similar to the findings of Susking et al (12) and Bonifacio et al (13).

In both of our groups, we found a statistical association between the results of culture with nitrites. Enterobacteriaceae are major producers of nitrite. In this investigation, the bacteria most frequently found were *E. coli* and *K. pneumoniae*, which belong to the Enterobacteriaceae family (6,13).

The proximity of the urinary system to the anus may be the reason that women in this study had cystitis in the last 2 years. Cystitis and recurrences of same are produced by fecal flora, which is a reservoir of strains that infect the urinary tract (6); around 75 to 90% of cystitis cases are related to sexual activity. Our results are in agreement with this assertion.

Using condoms may increase trauma, facilitating the colonization of uropathogens, and hence, such use is a risk factor for UTI (14). As did Scholes et al (15), we found that a high percentage of women in our study were using condoms.

In addition, previous hospitalization is a risk factor for acquiring multiresistant uropathogens (from the hospital environment) (16). In our study, we found a statistical

Table 1. Variable versus urine culture in studied groups.

Variable		College women		X²	p	Non-college women		X²	p
		Urine culture				Urine culture			
		Positive	Negative			Positive	Negative		
Age, years									
15 – 19		11	113	0.7	0.87	12	88	2.2	0.3
20 – 24		7	100			9	124		
25 – 29		2	22			3	20		
30 – 34		0	3			0	0		
Urinalysis results									
Nitrites	Abnormal	11	7	77.04	0.000*	11	230	112.03	0.000*
	Normal	9	231			13	2		
Leukocytes	Abnormal	10	37	14.70	0.000*	21	227	7.68	0.006*
	Normal	10	201			3	5		
Risk factors									
Wipes from back to front after urinating	Si	9	131	0.75	0.387	13	119	0.07	0.789
	No	11	107			11	113		
Has had cystitis in the last 2 years	Yes	17	146	4.44	0.035*	19	123	6.02	0.014*
	No	3	92			5	109		
Is sexually active	Yes	11	136	0.03	0.853	21	169	2.44	0.118
	No	9	102			3	63		
Practices birth control	Yes	10	127	0.08	0.772	22	215	0.03	0.858
	No	10	111			2	17		
Urinates after sexual intercourse	Yes	9	145	1.94	0.163	17	165	0.001	0.976
	No	11	93			7	67		
Experiences pain during penetration in sexual intercourse	Yes	4	58	0.19	0.660	5	59	0.24	0.620
	No	16	180			19	173		
Has a family history of cystitis	Yes	7	58	1.10	0.293	5	58	0.20	0.652
	No	13	180			19	174		
Used antibiotics 1 week earlier	Yes	1	44	2.33	0.127	2	62	3.92	0.048*
	No	19	194			22	170		
Has been hospitalized in the last 3 months	Yes	4	11	7.97	0.005*	0	2	0.21	0.648
	No	16	227			24	230		
Symptoms									
Dysuria	Yes	1	17	0.13	0.72	2	21	0.01	0.907
	No	19	221			22	211		
Urinary urgency	Yes	13	80	7.88	0.005*	8	81	0.02	0.877
	No	7	158			16	151		
Foul-smelling urine	Yes	11	120	0.15	0.694	3	11	2.50	0.113
	No	9	118			21	220		
Pollakiuria	Yes	1	43	2.23	0.136	3	31	0.01	0.906
	No	19	195			21	201		
Fever	Yes	0	22	2.021	0.15	0	3	0.31	0.575
	No	20	216			24	229		
Burning urination	Yes	8	53	3.21	0.07	18	187	0.43	0.513
	No	12	185			6	45		

*Results considered statistically significant at p<0.05.

association between this factor and having a positive urine culture, in college women.

The symptoms of a UTI are dysuria, pollakiuria, urinary urgency, and foul-smelling urine (17).

The women that participated in this study had some of these symptoms.

In both groups of women, logistic regression modeling indicated that some of these symptoms were predictive of a positive urine culture.

In this study, UTIs were mainly caused by *E. coli*, followed by *K. pneumoniae*. These bacteria can develop resistance to certain antibiotics (29). This situation, antibiotic resistance, increases morbidity, mortality, and the cost of treatment of UTIs.

The detection of these types of bacteria in the women from Cartagena who participated suggest these women were taking non-prescribed antibiotics or were failing to comply with their prescribed treatments; another possibility is that the bacteria originated in the hospital (particularly in the case of non-college women).

Finally, these studies are important because they provide information about antibiotic sensitivity patterns, which

Table 2. Results of binary logistic regression models

College women Variable	B	TE	OR	95% CI	p
Nitrites	3.861	0.683	47.492	12.462–180.986	0.000
Leukocyte esterase	1.797	0.618	6.030	1.795–20.256	0.004
Urinary urgency	-1.377	0.616	0.252	0.075–0.075	0.025
Constant (Y Intercept)	-1.101	0.769	0.333		0.152
Hosmer–Lemeshow goodness-of-fit test					0.897

Non-college women Variable	B	TE	OR	95% CI	p
Nitrites	5.291	0.947	198.640	31.033–1271.488	0.000
Had cystitis in last 2 years	-1.799	0.801	0.165	0.034–0.796	0.025
Constant (Y Intercept)	-0.947	0.848	0.388		0.264
Hosmer–Lemeshow goodness-of-fit test					0.716

B: regression coefficient; TE: typical deviation of the coefficient; OR: odds ratio; 95% CI: confidence interval of OR; p: significance.

Table 3. Antibiotic resistance profile

Antibiotic	E. coli		K. pneumoniae	
	College women (n = 9)	Non-college women (n = 16)	College women (n = 7)	Non-college women (n = 5)
Amoxicillin-clavulanate	1	9	3	3
Cefuroxime	-	5	-	-
Cefotaxime	-	5	-	-
Ceftazidime	-	5	-	-
Cefazolin	4	10	4	4
Cefoxitin	-	6	2	3
Cefalotin	4	6	4	4
Ertapenem	-	4	1	-
Meropenem	-	5	1	-
Ciprofloxacin	-	6	1	-
Amikacin	-	5	1	-
Gentamicin	-	7	-	-
ESBL (Ceftazidime/ Ceftazidime-clavulanate)	-	1	-	-

ESBL: Extended-spectrum β-lactamases

information will aid healthcare personnel in prescribing effective treatments and counteracting antibiotic resistance (18).

A limitation of this study was that we couldn't use stratified random sampling in some areas of the city of Cartagena because of the difficulty of enlisting participants.

Resumen

Objetivo: comparar la frecuencia, etiología y factores de riesgo en infecciones del tracto urinario en mujeres universitarias y no universitarias. Metodo: estudio de corte transversal en el que fueron incluidos 258 mujeres universitarias y 256 no universitarias entre 17 y 34 años de edad. A las participantes se les aplicó un cuestionario para evaluar factores de riesgo. Se procesaron muestras de orinas de las mujeres por urianálisis para buscar signos de infección urinaria y se confirmaron por cultivo. Las bacterias identificadas se les determinó su perfil de sensibilidad por la técnica de Kirby Bauer. Se aplicó la prueba de Chi cuadrado y se desarrolló una regresión logística binaria. Resultados: Se encontraron infecciones urinarias en 7.8% de mujeres universitarias y 9.4% de mujeres no universitarias. El uropatógeno más frecuente en ambos grupos fue *E. coli*. Las bacterias más frecuentes fueron resistentes a betalactámicos. El Análisis de Regresión Logística Binaria mostró que, para el grupo de mujeres universitarias, las variables predictoras fueron nitritos, leucocitos y tenesmo vesical. En el grupo no universitarias, las variables predictoras fueron nitritos y cistitis en los dos últimos años. Conclusion: se encontró una frecuencia similar de infecciones del tracto urinaria en ambos grupos. Los resultados sugieren que muchas mujeres usan antibióticos no recetados, incumplen con el tratamiento o que las bacterias tienen un origen hospitalario.

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