Research Article

Prevalence and characterization of urinary tract infection among pregnant women from the Eje Cafetero (Coffee Axis), 2015-2018

Abstract

Introduction: Bacterial infections of the urinary tract are the most common infections among pregnant women; They are associated with the anatomical and physiological changes typical of pregnancy. Timely diagnosis and treatment is mandatory, due to potential maternal-fetal complications.

Objective: to estimate the prevalence and characterization of urinary infections in pregnant women from the Coffee Region (Colombia).

Materials and methods: Cross-sectional study. 473 pregnant women over 18 years old, with symptoms of urinary tract infection and positive urine culture; admitted to the prenatal outpatient clinic, the emergency department or hospitalized were included. The research was carried out in three private level III care hospitals in three cities of the Eje Cafetero (Coffee Axis) (Armenia, Pereira, and Manizales); between July 2015 and June 2018. Description was stratified by age (18 to 29 years, 30 to 39 years and over 40 years). Descriptive statistics were used to analyze the information. Sample calculation and simple random selection were made.

Results: the mean age of the participants was 26.58±7.49 years (minimum 18 and maximum 48). The prevalence of urinary infection was 9.72%. The age group with the highest frequency of urinary infection was 18 to 29-year-old (45.65%), and the lowest frequency was in those over 40 (17.39%). Women in their second trimester were the most affected ones. (52.17%). The germ found the most in urine culture was *Escherichia coli* (73.91%), followed by *Klebsiella spp* (8.69%). 2.74% presented asymptomatic bacteriuria, 5.07% acute cystitis and 1.9% acute pyelonephritis. The rate of recurrent urinary infection detected was 2.53%.

Conclusion: There is a significant prevalence of urinary infection in pregnant women from the Coffee Region, close to one-tenth of the population, characterized mainly by acute cystitis; with predominance of *Escherichia coli* and *Klebsiella spp.* germs early interventions are required to establish both an immediate diagnostic and therapeutic plan.

Keywords: prevalence, cystitis, bacteriuria, pyelonephritis, pregnant women

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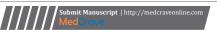
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Introduction

Urinary infection is microbial colonization and multiplication, usually bacterial, along the urinary tract, with or without symptoms.[1] Throughout their lives, more than half of women will have at least one urinary infection;[2] being much more frequent during pregnancy,[3] and becoming one of the most common infectious complications in pregnancy. Urinary infections are classified by the site of infection, including urine (bacteriuria), bladder (cystitis), or kidney (pyelonephritis);[4] although traditionally they have been classified, depending on whether they affect the proximal part (upper urinary tract infection) or the distal part (lower urinary tract infection).[5] The incidence of asymptomatic bacteriuria and acute cystitis during pregnancy is 2-10% and 1-4%, respectively.[6,7] Around 20-40% of pregnant women with asymptomatic bacteriuria will develop pyelonephritis during pregnancy.[8–10] Acute pyelonephritis in pregnancy is the most severe picture of a urinary infection, which can lead to maternal and perinatal complications;[9,11] it usually occurs in 1-2% of pregnant women, particularly during the end of the second and beginning of the third trimester.[12–14] It is usual that a single microorganism is responsible for the urinary infection, in more than 95% of cases; being the most frequent germ Escherichia coli (75-80%); the remaining 20-25% includes *Enterococcus spp, Klebsiella spp, Proteus mirabilis, Proteus vulgaris, Pseudomonas aeruginosa Staphylococcus saprophyticus*, among others.[3,15,16] In the diagnosis, clinical evaluation is always first, prevailing over tests and office studies, which should only be considered to guide the presumptive diagnosis.[17] Urine examination is especially useful, since leukocytes, pyocytes and red blood cells can be observed in up to 40-60% of urinary infections.[18] Pyuria (presence of more than 5 leukocytes per field in centrifuged urine, equivalent to the count of more than 20 leukocytes/mm^3 in uncentrifuged urine), has a sensitivity of 80-95% and specificity of 50-76%.[17,19] Bacteriuria (detected by Gram stain, one or more bacteria in uncentrifuged urine) is less sensitive (40-70%) but more specific (85-95%).[19] Test strips are useful for measuring leukocyte esterase and/or nitrites, they are used as a diagnostic approach; they have a specificity of 59-96% and sensitivity of 68-98% for the detection of uropathogens whose concentration is equivalent to ≥105 CFU/mL.[20] The strips used for the measurement of nitrites have a sensitivity of 19-45% and a specificity of 95-98%.[20]

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The joint performance of these two tests increases the sensitivity to 88-92% and specificity to 78-98%.[20]

Urine culture is the gold standard for the diagnosis of any form of urinary infection.[19] It is considered positive when there is a report of more than 105 CFU/mL.[21] In the Eje Cafetero (Coffee Axis) there is limited information on the incidence and prevalence of urinary infections in pregnant women; that is why the objective of this research was to estimate the prevalence and characterization of urinary infections in pregnant women from the Eje Cafetero (Coffee Axis); women in prenatal care, who consulted the emergency services or were hospitalized, in three private level III care clinics.

Materials and methods

Design and population

Descriptive cross-sectional observational study. Pregnant women over 18 years of age, with symptoms of urinary tract infection (dysuria, chills, fever, stranguries, lumbar pain, frequency, urgency, urgency, macroscopic hematuria, suprapubic pain, positive percussion fist, cloudy urine and / or smelly) and positive urine culture were included; Eje Cafetero (Coffee Axis) inhabitants, who were admitted to the prenatal outpatient clinic, to the emergency service or who were hospitalized, in three highly complex private clinics, in each of the main cities of the Coffee Region (Armenia, Pereira and Manizales). These institutions serve the population of the contributory and subsidized regimes of Colombia´s health care system. This study was conducted between July 1, 2015 and June 30, 2018. Women with genital bleeding at the time of the examination, twin pregnancy (due to its association with an increase in the incidence of urinary tract infection), isthmic-cervical insufficiency, anatomical malformations of the urinary tract, fetal malformations (in order not to increase stress maternal), psychiatric illnesses, neurological deficit, mental retardation, antibiotic treatment in the previous 7 days and a history of cancer. A sample of 406 participants was derived from the universe of pregnant women who entered the study period; 95% confidence interval, and a 3% error, however, 473 women were included, to cover losses. Simple random sampling was applied for the selection of pregnant women, using a computer program.

Procedure

In each of the participating clinics, pregnant women who were in prenatal care, visited the emergency care unit or were hospitalized in the maternity service with an apparent normal pregnancy, course were identified by the treating obstetrician. The following international classification of diseases (ICD10) was used for disease classification: O23.0 Kidney infections in pregnancy; O23.1 Infections of the bladder in pregnancy; O23.3 Infection of other parts of the urinary tract in pregnancy; O23.4 Unspecified urinary tract infection in pregnancy. A general practitioner, expert in pregnant care, part of the research team, oversaw the evaluation of each pregnant woman, to determine if she met the eligibility criteria of the study. If pregnant woman fulfilled the inclusion criteria, she was informed of the objectives of the research, as well as the purpose of the results, and she was asked to sign the informed consent. Once consent was obtained, the nursing assistant in charge of taking the sample oversaw the genital washing process, to guarantee the correct collection of the urine sample (the sample was collected from the middle of the urine stream). A complete urine test was performed and a urine culture with an antibiogram was performed. The diagnosis of urinary infection is confirmed through a positive urine culture performed with CHROMID® CPS® Elite reagent medium, which is processed by counting sowing and, depending on the number of colonies; was read by a bacteriologist specialized in microbiology and analyzed by an obstetrician to establish the diagnosis. The isolated bacterial strains were analyzed on identification cards for genus and species, and on another card for sensitivity to the following antibiotics: Ampicillin, Ampicillin-sulbactam, Amoxicillin-clavulonate, Aztreonam, Cephalothin, Ceftriaxone, Amikacin, Phosphomycin, Gentamicin, Meropenem, Nitrofurantoin, Piperacillin-tazobactam, Trimethoprim-sulfamethoxazole. The nursing assistants, in charge of data collection, searched for information in the clinical history; those with missing data were interviewed by the head nurse of the prenatal control program. A questionnaire designed by the researchers was applied, through which the information on the characteristics and clinical manifestations was uniformly extracted. The data was digitized into an Excel 12.0 spreadsheet, from where it was exported, stored, and processed in a database of the SPSS® v20 statistical program.

Measured variables

socio-demographic, gyneco-obstetric history (parity, history of abortion, weeks of gestation, trimester of pregnancy), personal history, clinical manifestations, entities related to urinary tract infection, germs reported in urine culture, antimicrobial sensitivity profile, as well as the prevalence rate, which was calculated with respect to the number of pregnant women with urinary infection over the total number of participants.

Statistical analysis

Descriptive statistics were used to analyze the information. In the quantitative variables, the mean, standard deviation (SD), median and range were calculated; in the qualitative, proportions were used.

Ethical aspects

The research was approved by the Medical Ethics Committee, by act No. 0123; The ethical principles of the Declaration of Helsinki and Resolution 8430 of 1993 of the Ministry of Health of Colombia were followed. The confidentiality of information, anonymity, and privacy of the data of the patients and the research team were guaranteed.

Results

A total of 734 pregnant women were invited to participate in the research; of these, 107 (14.57%) did not meet the inclusion criteria, 31 (4.22%) refused to participate, 79 (10.76%) had genital bleeding, twin pregnancy, isthmic-cervical insufficiency, anatomical malformations of the urinary tract, fetal malformations or received antibiotic treatment in the previous 7 days, 44 (5.99%) did not provide complete information, therefore they were excluded. The final analysis was performed with a total of 473 (64.44%) pregnant women. The sociodemographic characteristics of the total population of pregnant women reported that the average age of the participants was 26.58±7.49 years, median of 25 years (range between 18 and 48). The majority (86.89%) came from the urban area, affiliated with the contributory health care plan (83.93%) and their religion was Catholic (89.85%) (Table 1). The gestational age, at the time of diagnosis of the urinary infection, reported an average of 23.71±4.58 weeks, with a median of 21weeks, (range between 9 and 39). The mean of prenatal controls reported a median of 3 (range between 1 and 7). The sexual and reproductive health history showed a median of 3 children (2 vaginally and 1 cesarean section per woman), ranging between 1 and 8 children. The multiparous to nulliparous ratio was 3:1.80.97% of the pregnant women affirmed having had more than three pregnancies, of which 83.81% were unplanned. The prevalence of abortions was

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26.84%, of these 1.47% were done through the voluntary interruption of pregnancy (VIP) and 6.29% were induced and practiced under risky conditions (self-formulated drugs or in clandestine places).

Table 1 Sociodemographic characteristics in pregnant women, Eje Cafetero (Coffee Axis), Colombia, 2015-2018

Variable and categories	n/proportion (%)
Age: X ± SD years	26,58 ± 7,49
Age of partner: X ± SD	29,74 ± 6,13
Weight: X ± DE Kg	64,87 ± 9,57
Height: X ± DE Cms	161,35 ± 7,13
BMI: X ± SD	25,14 ± 6,38
Ethnic group	
Hispanics	299 (63,21)
Afro descendants	146 (30,86)
Indigenous	28 (5,91)
Socioeconomic status	
Low	52 (10,99)
Middle	335 (70,82)
High	86 (18,18)
Civil Status	
Married or Common Law	318 (67,23)
Single	82 (17,33)
Divorced	56 (11,83)
Widows	17 (3,59)
Scholarship	
Primary	41 (8,66)
Secondary	197 (41,64)
Technical	116 (24,52)
Professionals	119 (25,15)
Occupation	
Employed	94 (19,87)
Independent	73 (15,43)
Unemployed	101 (21,35)
Housewives	205 (43,34)

Sexual behavior reported that the average age of initiation of sexual life was 16.35±2.46 years, with a median of 7 sexual partners (range between 1 and ≥20). The average time spent with a partner was 8.15±3.16 years. To the question, how many times did you have sex in the past week? (Period defined as the span of the previous seven days), a median of 2 was found (range between 0 and 5). In the personal history, the prevalence of gestational diabetes mellitus was 5.91%, pregestational diabetes 2.74%, vaginitis 27.69%, vaginosis 35.94%, clinical hypothyroidism 14.37% and chronic HT 1.69%.

56.87% had a history of at least one episode of urinary infection in the present pregnancy, and 65.96% in previous pregnancies. In 46 women the presence of urinary tract infection was diagnosed, for a prevalence of 9.72%. The characterization by age groups was as follows: 18 to 29 years, 21 cases (45.65%); from 30 to 39years, 17 cases (36.95%) and over 40 years, 8 cases (17.39%). In the first trimester the prevalence was 34.78% (n=16/46), in the second 52.17% (n=24/46) and in the third trimester 13.04% (n=6/46). Regarding clinical manifestations, dysuria (71.73%) and frequency (69.56%) predominated (Table 2).

Table 2 Symptoms of urinary infection in pregnant women, Eje Cafetero (Coffee Axis), Colombia, 2015-2018

Clinical manifestations	n(%)
Asymptomatic	13 (28,26)
Dysuria	33 (71,73)
Pain in lumbosacral region	13 (28,26)
Suprapubic pain	17 (36,95)
Shaking chills	20 (43,47)
Fever	22 (47,82)
Pollakiuria	32 (69,56)
Tachycardia	26 (56,52)
Bladder tenesmus	24 (52,17)
Urinary urgency	27 (58,69)

In the urine culture, the germ most frequently detected was *Escherichia coli* (73.91%), followed by *Klebsiella spp* (8.69%) and, in third place, *Enterococcus spp* (6.52%) (Table 3). *Escherichia coli* showed resistance to the antibiotics frequently used at the hospital level, such as ampicillin (67.64%), cephalothin (55.88%) and gentamicin (52.94%); but higher sensitivity against piperacillin-tazobactam (94.11%) and meropenem (91.17%). The antimicrobial susceptibility profile of *Escherichia coli* is described in Table 4. A frequency of 11.76% of *Escherichia coli* producing extended spectrum β-lactamases (ESBL) was observed. When characterizing the 3 entities related to urinary infection, it was found that 2.74% (n=13/473) presented asymptomatic bacteriuria, 5.07% (n=24/473) acute cystitis and 1.9% (n=9/473) Acute pyelonephritis. Recurrent urinary infection was detected in 2.53% (n=12/473). In obstetric complications, a threat of abortion was found, 20.93%, anemia 18.81%, threat of premature birth 11.83%, intrauterine growth restriction 10.35%, pre-eclampsia 9.72% and premature rupture of the membranes ovular 7.18%.

Table 3 Characterization of uropathogens in pregnant women with urinary infection, Eje Cafetero (Coffee Axis), Colombia, 2015-2018

Clinical manifestations	n (%)
Escherichia coli	34 (73,91)
Klebsiella spp	4 (8,69)
Enterococcus spp	3 (6,52)
Proteus spp	2 (4,34)
Pseudomonas spp	1 (2,17)
Enterobacter spp	1 (2,17)
Streptococcus spp	1 (2,17)

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Table 4 Characterization of uropathogens in pregnant women with urinary infection, Eje Cafetero (Coffee Axis), Colombia, 2015-2018

Antibiotics	Sensitivity	n (%)
Amoxicillin-clavulanate	S	73.52
	I	2.94
	R	23.52
Ampicillin	S	67.64
	I	5.88
	R	26.47
Ampicillin-sulbactam	S	64.70
	I	5.88
	R	29.41
Aztreonam	S	91.17
	I	2.94
	R	5.88
Cephalothin	S	55.88
	I	14.70
	R	29.41
Ceftriaxone	S	41.17
	I	14.70
	R	44.11
Amikacin	S	61,76
	I	11,76
	R	26,47
Fosfomycin	S	91.17
	I	5.88
	R	2.94
Gentamicin	S	52.94
	I	20.58
	R	26.47
Meropenem	S	91.17
	I	5.88
	R	2.94
Nitrofurantoin	S	82.35
	I	11.76
	R	5.88
Piperacillin-tazobactam	S	94.11
	I	2.94
	R	2.94
Trimetoprim-sulfametoxazol	S	73.52
	I	17.64
	R	8.82

S: sensitive I: intermediate R: resistant

Discussion

In this investigation, a prevalence of urinary infection in pregnancy of 9.72% was found. The age group where the highest frequency of infection was observed was that of 18 to 29 years (45.65%), the second trimester being the most affected one (52.17%), while the germ presents more frequently, in the Urine culture, it was *Escherichia coli* (73.91%). In the clinical manifestations, dysuria (71.73%) predominated, followed by frequency (69.56%). In our findings, the prevalence of urinary tract infection in pregnant women is higher than the1.78% reported by Vallejos et al.[22] in 83 participants in Puebla (Mexico) or the 7.4% published by Quirós-Del Castillo et al.[23] in Lima (Peru); although much lower than the 26% registered by Parveen et al.[24] in Dhaka (South Asia), or the 21.7% described by Akinloye et al.[25] in 300 pregnant women from Ibadan (Nigeria).

The difference is explained both by the divergence in the inclusion and exclusion criteria, as well as because the pregnant women were cared for in different institutions, without homogenizing follow-up. Regarding the prevalence of urinary infection per quarter, our results are similar to those of Onuh et al.[26] in 542 pregnant women from Abakaliki, Ebonyi State, (Nigeria), who reported a high prevalence of urinary tract infection in the second trimester compared to the first and third trimesters; but different from those of Leigh et al.[27] who reported an increase in the frequency of urinary tract infection in the third trimester compared to the first and second trimesters of pregnancy.

Escherichia coli has been identified in 80-85% of urinary tract infections,[28] which is slightly higher than the 73.91% in our study, but much more than the 64% described by Ferreira et al. [29] in 50 hospitalized pregnant women, in Neiva (Colombia), but totally higher than the 55.6% published by Autún et al.[30] in Tlalnepantla (México).[30] In Tlalnepantla (Mexico). The differences are explained by sociodemographic characteristics, as well as a history of medical illnesses. In our study, the antimicrobial sensitivity profile of *Escherichia coli* is resistant to ampicillin in 67.64%, to cephalothin in 55.88%, to ceftriaxone in 44.11% and to gentamicin in 52 94%, which are the most frequently used antibiotics in our environment. Resistance to amoxicillin-clavulonate, ampicillin-sulbactam and trimethoprim-sulfamethoxazole, was less than 30%, and less than 10% of the strains were resistant to aztreonam, fosfomycin, meropenem and piperacillin-tazobactam. The resistance to nitrofurantoin reached 82.35%. These findings are lower than that reported by Ferreira et al.[29] *Escherichia coli*, producing extended spectrum β-lactamases (ESBL), was isolated by Quirós-Del Castillo et al.[23] in 16.3% of pregnant women, in contrast to our 11.76%, or the 47% published by Rizvi et al.[31] This is explained by its relationship with the adequate prescription of antibiotics in our institutions, which has been promoted in the last decade, thanks to the exercise carried out in Bogotá.[32]

When characterizing the 3 entities related to urinary infection, our results are not consistent with the 19.1% reported by Autún et al.[30] or 13.8% published by Tomás-Alvarado et al.[33] There is a paucity of data on acute cystitis in pregnancy, but available studies show that it ranges from 1–4%.[34-36] The prevalence of acute pyelonephritis, in most reports, ranges between 0.5-2% of pregnancies,[37-40] which is consistent with our findings. The performance of a urine culture, at the beginning of pregnancy, should be of routine use in prenatal control, and if it is positive, requesting the antimicrobial sensitivity profile is mandatory before proceeding to establish antibiotic therapy.[41,42] They identified it as ESBL-producing *Enterobacteriaceae*, we report it as an epidemiological situation to evaluate, since it is a variable that is usually unknown in our country, particularly in pregnant women; therefore, our findings confirm the urgent need to establish an adequate control in the policies for antibiotics usage. The main strength of this research is that it is multicenter, which gives it the advantage of rapid recruitment, a larger number of participants and a faster development of the same, in addition to having a significant number of pregnant women. Among the limitations to be highlighted, we noted that the response to therapy was not evaluated, nor were the complications of urinary tract infection described in pregnancy. Regarding maternal-fetal complications observed in this study, it remains unknown whether they are causally related to urinary tract infection or are the product of the bias of including reference institutions for high-risk pregnant women.

Conclusion

In pregnant women from the Coffee Region there is a significant prevalence of urinary infection, which is close to a tenth of the

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population, characterized mainly by acute cystitis; predominating the germs *Escherichia coli* and *Klebsiella spp*. Early interventions are required to establish both an immediate diagnostic and therapeutic plan to estimate the effect on the need for hospitalization and costs at the regional level. It is suggested to carry out multicenter studies involving a larger sample, which allows us to corroborate or contrast our results, to modify and adjust (as far as possible) the clinical guidelines for the diagnosis and treatment of urinary infection in pregnant women of the region.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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