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, 20-40% of pregnant women with asymptomatic bacteriuria will develop pyelonephritis during pregnancy.

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

Introduction

Urinary infection is microbial colonization and multiplication, usually bacterial, along the urinary tract, with or without symptoms. Throughout their lives, more than half of women will have at least one urinary infection; being much more frequent during pregnancy, 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); 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). The incidence of asymptomatic bacteriuria and acute cystitis during pregnancy is 2-10% and 1-4%, respectively. Around 20-40% of pregnant women with asymptomatic bacteriuria will develop pyelonephritis during pregnancy. Acute pyelonephritis in pregnancy is the most severe picture of a urinary infection, which can lead to maternal and perinatal complications; it usually occurs in 1-2% of pregnant women, particularly during the end of the second and beginning of the third trimester. 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. In the diagnosis, clinical evaluation is always first, prevailing over tests and office studies, which should only be considered to guide the presumptive diagnosis. Urine examination is especially useful, since leukocytes, pyocytes and red blood cells can be observed in up to 40-60% of urinary infections. Pyuria (presence of more than 5 leukocytes per field in centrifuged urine, equivalent to the count of more than 20 leukocytes/mm³ in uncentrifuged urine), has a sensitivity of 80-95% and specificity of 50-76%. Bacteriuria (detected by Gram stain, one or more bacteria in uncentrifuged urine) is less sensitive (40-70%) but more specific (85-95%). 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. The strips used for the measurement of nitrites have a sensitivity of 19-45% and a specificity of 95-98%.
The joint performance of these two tests increases the sensitivity to 88-92% and specificity to 78-98%.

Urine culture is the gold standard for the diagnosis of any form of urinary infection. It is considered positive when there is a report of more than 105 CFU/mL. 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), anamnestic-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 positive urine culture were excluded; 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), anamnestic-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 positive urine culture were excluded.

Final analysis was performed with a total of 473 (64.44%) pregnant women, a median of 21 weeks, (range between 9 and 39). The mean of prenatal care, reported an average of 23.71±4.58 weeks, with 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), anamnestic-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 positive urine culture were excluded. 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, anamnestic-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 21 weeks, (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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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 39 years, 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).

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-sulfamethoxazole | S       | 73.52       |
|                           | I           | 17.64       |
|                           | R           | 8.82        |

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%), 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 the 1.78% reported by Vallejos et al. in 83 participants in Puebla (Mexico) or the 7.4% published by Quirós-Del Castillo et al. in Lima (Peru); although much lower than the 26% registered by Parveen et al. in Dhaka (South Asia), or the 21.7% described by Akinloye et al. 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. in 542 pregnant women from Abakaliki, Ebony 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. 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, which is slightly higher than the 73.91% in our study, but much more than the 64% described by Ferreira et al. in 50 hospitalized pregnant women, in Neiva (Colombia), but totally higher than the 55.6% published by Autún et al. in Tlalnepantla (México). 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-clavulanate, 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. Escherichia coli, producing extended spectrum β-lactamases (ESBL), was isolated by Quirós-Del Castillo et al. in 16.3% of pregnant women, in contrast to our 11.76%, or the 47% published by Rizvi et al. 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.

When characterizing the 3 entities related to urinary infection, our results are not consistent with the 19.1% reported by Autún et al. or 13.8% published by Tomás-Alvarado et al. There is a paucity of data on acute cystitis in pregnancy, but available studies show that it ranges from 1–4%. The prevalence of acute pyelonephritis, in most reports, ranges between 0.5-2% of pregnancies, 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. 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, the limitations to be highlighted, we noted that the response to therapy was not evaluated, nor were the complications of treatment.

Conclusion

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