Species Distribution and Reported Antimicrobial Susceptibility of Bacteria Recovered from Urine and Vaginal Swabs of Pregnant Women in Maysan, Iraq

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Abstract

Background: Bacterial isolates recovered from urine and vaginal specimens during pregnancy require interpretation in relation to specimen type and clinical findings. This study described the distribution of bacterial isolates and summarized the available antimicrobial susceptibility records from a maternity hospital in Maysan, southern Iraq.

Methods: Midstream urine and vaginal swab specimens were obtained from pregnant women aged 20–40 years. Isolates were characterized by conventional laboratory methods and identified using VITEK 2. Species distributions were calculated from 22 reported isolates, with specimen-specific percentages based on the listed urine or vaginal isolate totals.

Results: *Escherichia coli* and *Staphylococcus aureus* each accounted for 10 of 22 isolates (45.5%). *Enterococcus faecalis* and *Klebsiella pneumoniae* each accounted for 1 of 22 (4.5%). *Staphylococcus aureus* was the most frequent species among urine isolates (6/11, 54.5%), and *E. coli* was the most frequent among vaginal isolates (7/11, 63.6%). The antimicrobial summary listed 207 susceptible and 110 resistant results across the four species.

Conclusions: The two specimen groups differed descriptively in their most frequent bacterial isolate. This small, single-center series describes the composition of the reported isolates. Estimating infection prevalence or species-specific antimicrobial susceptibility requires specimen and testing denominators, respectively.

Keywords: *pregnancy; urine; vaginal swab; bacterial isolates; antimicrobial susceptibility; Maysan*

Introduction

Bacterial findings in urine in pregnancy may be asymptomatic bacteriuria and symptomatic urinary tract infection may be presented as acute cystitis or pyelonephritis [1,2]. Asymptomatic bacteriuria is defined as bacterial growth at a specific quantitative threshold in the absence of urine symptoms [2]. A Cochrane study found therapy may reduce pyelonephritis but certainty of evidence was poor [3]. This connection has also been studied in a prospective Dutch cohort among a selected population of women with singleton pregnancies [4]. These differences become important when comparing studies that used different criteria for screening, culture interpretation, and case classification. Vaginal swabs need a different interpretation. Aerobic vaginitis is defined as disturbed vaginal microbiota and

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inflammation based on microscopy and clinical observations [5,6,7]. A single vaginal swab that grows an aerobic organism does not establish a diagnosis of vaginitis. A research in Iraq analyzed Enterococcus faecalis in women screened for aerobic vaginitis [8]. Its findings underscore the importance of the clinical context in the description of organisms obtained from vaginal specimens.

Escherichia coli was described as one of the frequent urine isolates in pregnant women [9,10] and variation in antibiotic susceptibility was found in studies conducted in Ethiopia. Regional comparisons are available from hospital data in Al Samawa, Iraq and studies in Palestine and Riyadh but recruiting and culture criteria are different [11,12,13]. Such discrepancies hinder transferability of estimates between environments. Separate description of the urine and vaginal isolates can show the organisms isolated from each specimen type at the maternity hospital in Maysan. The purpose of this study was to evaluate the distribution of bacterial species among urine and vaginal isolates obtained from pregnant women at the Maternity and Children's Hospital in Maysan in southern Iraq and to review the available in vitro antibiotic susceptibility records.

Methods

Study setting and specimens

Midstream urine and vaginal swab specimens (22) were obtained from pregnant women aged 20–40 years attending the microbiology section of the Maternity and Children's Hospital in Maysan Governorate, Iraq for this descriptive study. Informed consent was acquired from subjects. Questionnaires recorded age and the use of antibiotics.

Bacterial identification

The laboratory identified the isolates by colony morphology and hemolysis on the reported culture media, Gram stain, and biochemical testing including catalase and oxidase testing. VITEK 2 was used for species confirmation. The data did not contain urine colony counts or specimen-specific diagnostic criteria for symptomatic urinary tract infection, asymptomatic bacteriuria, or vaginitis.

Analysis of isolate distribution and susceptibility records

The analytical unit was the isolate. Overall species percentages were computed with the 22 reported isolates as the basis. Specimen-specific percentages employed 11 urine isolates or 11 vaginal isolates as the basis as documented by the species counts. Percentages have been rounded to one decimal place. Analysis was descriptive. The report from the lab showed susceptible (S) and resistant (R) percentages in two different columns, with a pooled total of 207 S and 110 R values. These percentages were transcribed as reported and aligned by species and agent [14].

Results

Distribution of bacterial isolates

E. coli and *S. aureus* each accounted for 10 isolates (45.5%), followed by *E. faecalis* and *K. pneumoniae* with one each (4.5%; Table 1). The most frequent species was *S. aureus* among urine isolates (6/11, 54.5%) and *E. coli* among vaginal isolates (7/11, 63.6%). The single *E. faecalis* and *K. pneumoniae* isolates were recovered from urine (Table 2).

Table 1. Overall distribution of bacterial isolates

Species	Isolates, n	Share of all isolates (%)
Escherichia coli	10	45.5
Staphylococcus aureus	10	45.5

Species	Isolates, n	Share of all isolates (%)
Enterococcus faecalis	1	4.5
Klebsiella pneumoniae	1	4.5
Total	22	100.0

Table 2. Bacterial isolates by specimen type

Species	Urine, n (%)	Vaginal swab, n (%)
Escherichia coli	3 (27.3)	7 (63.6)
Staphylococcus aureus	6 (54.5)	4 (36.4)
Enterococcus faecalis	1 (9.1)	0 (0.0)
Klebsiella pneumoniae	1 (9.1)	0 (0.0)
Total	11 (100.0)	11 (100.0)

Antimicrobial susceptibility records

Table 3 presents the recorded antimicrobial susceptibility results for the four bacterial species. Across all antimicrobial agents, the pooled totals were 207 susceptible and 110 resistant results.

Table 3. Reported antimicrobial susceptibility summary by species and agent

Species	Antimicrobial agent	Reported S (%)	Reported R (%)
E. coli	Ampicillin	1.4	6.3
E. coli	Amoxicillin/clavulanic acid	3.8	1.8
E. coli	Piperacillin/tazobactam	3.8	1.8
E. coli	Cefotaxime	2.4	4.5
E. coli	Ceftazidime	2.4	4.5
E. coli	Cefepime	2.4	4.5
E. coli	Ertapenem	3.8	1.8
E. coli	Imipenem	3.8	1.8
E. coli	Meropenem	3.8	1.8
E. coli	Gentamicin	4.3	0.9
E. coli	Ciprofloxacin	3.8	1.8
E. coli	Norfloxacin	3.8	1.8
E. coli	Fosfomycin	4.8	—
E. coli	Trimethoprim/sulfamethoxazole	2.4	4.5
E. coli	Nitrofurantoin	4.3	—
E. coli	Amikacin	4.8	—
S. aureus	Gentamicin	4.3	—

Species	**Antimicrobial agent**	**Reported S (%)**	**Reported R (%)**
S. aureus	Benzylpenicillin	—	8.1
S. aureus	Ciprofloxacin	2.8	2.7
S. aureus	Oxacillin	—	8.1
S. aureus	Moxifloxacin	3.3	—
S. aureus	Linezolid	3.3	—
S. aureus	Erythromycin	—	9
S. aureus	Teicoplanin	3.8	1.8
S. aureus	Clindamycin	—	7.2
S. aureus	Vancomycin	3.8	0.9
S. aureus	Tetracycline	1.9	5.4
S. aureus	Tigecycline	4.8	—
S. aureus	Fusidic acid	0.9	7.2
S. aureus	Rifampicin	3.3	2.7
S. aureus	Trimethoprim/sulfamethoxazole	3.8	1.8
E. faecalis	Linezolid	0.4	—
E. faecalis	Levofloxacin	—	0.9
E. faecalis	Teicoplanin	0.4	—
E. faecalis	Erythromycin	—	0.9
E. faecalis	Vancomycin	0.4	—
E. faecalis	Tetracycline	—	0.9
E. faecalis	Tigecycline	0.4	—
E. faecalis	Nitrofurantoin	0.4	—
K. pneumoniae	Piperacillin/tazobactam	0.4	—
K. pneumoniae	Cefoxitin	0.4	—
K. pneumoniae	Ceftazidime	0.4	—
K. pneumoniae	Cefepime	0.4	—
K. pneumoniae	Ertapenem	0.4	—
K. pneumoniae	Imipenem	0.4	—
K. pneumoniae	Amikacin	0.4	—
K. pneumoniae	Gentamicin	0.4	—
K. pneumoniae	Ampicillin	—	0.9
K. pneumoniae	Ciprofloxacin	0.4	—
K. pneumoniae	Cefazolin	—	0.9
K. pneumoniae	Levofloxacin	0.4	—

Species	Antimicrobial agent	Reported S (%)	Reported R (%)
K. pneumoniae	Ceftriaxone	—	0.9
K. pneumoniae	Tigecycline	0.4	—
K. pneumoniae	Trimethoprim/sulfamethoxazole	—	0.9

S = susceptible. R = resistant. A dash indicates that the source reported no value for that category. The original summary gave separate pooled totals of 207 S and 110 R results across organisms and agents.

Discussion

In the pooled data set, E. coli and S. aureus were equally prevalent. The pattern varied with the type of specimen. Seven of the eleven vaginal isolates were E. coli and six of the eleven urine isolates were S. aureus. Studies using urine samples in pregnant women in Ethiopia have commonly revealed E. coli [9,10]. In Al Samawa, Iraq Escherichia coli was the most common urine isolate followed by Staphylococcus aureus. In a prospective cohort from Palestine [11,12], E. coli was similarly the most common isolate. In Maysan, Staphylococcus aureus was isolated from 6 of 11 reported urine isolates. A number of factors are possible for its presence in urine, such as contamination, colonization or infection and clinical context is therefore essential [15]. Vaginal swab recovery of a species may indicate colonization or infection, depending on clinical and laboratory results. In Iraq, a study on E. faecalis was conducted on women who were assessed for aerobic vaginitis [8]. In the present series the only E. faecalis isolate was from urine.

Table 3 summarizes the susceptibility categories recorded for the four bacterial species. These categories are interpreted using breakpoints specific to the organism and antimicrobial agent [14].

Cumulative antibiograms quantify the proportion susceptible using valid data for a specific organism–agent pair and take account of repeat isolates [16]. Classification of multidrug resistance also depends on whether antimicrobial categories are represented by non-susceptibility in the same isolate [17]. The pooled findings available do not allow either analysis to be recreated. Evidence for clinical consequences such as pyelonephritis following asymptomatic bacteriuria is based on research in defined patient populations and their follow-up [3].

Limitations

This single-center study included 22 bacterial isolates, limiting the generalizability of the findings. The total number of women screened and the number of culture-negative specimens were unavailable, precluding estimates of infection prevalence or incidence. The absence of participant identifiers prevented assessment of repeat sampling, and the study had no nonpregnant comparison group. Clinical findings and quantitative culture data were insufficient to distinguish infection from colonization or specimen contamination. Isolate-level susceptibility results linked to specimen type and the number of isolates tested for each species–drug combination were unavailable, limiting interpretation of resistance by specimen type and precluding calculation of species-specific resistance rates for individual agents.

Conclusion

Among the 22 bacterial isolates recovered from specimens collected from pregnant women at a maternity hospital in Maysan, E. coli and S. aureus were equally frequent (10/22 each, 45.5%). S. aureus was the most frequently recovered species from urine (6/11, 54.5%), whereas E. coli was the most frequently recovered from vaginal swabs (7/11, 63.6%). These proportions describe the distribution of isolates within each specimen group at the study hospital.

References

[1] American College of Obstetricians and Gynecologists' Committee on Clinical Consensus–Obstetrics. Urinary tract infections in pregnant individuals. Obstet Gynecol. 2023;142(2):435–445. https://doi.org/10.1097/AOG.0000000000005269

[2] Nicolle LE, Gupta K, Bradley SF, et al. Clinical practice guideline for the management of asymptomatic bacteriuria: 2019 update by the Infectious Diseases Society of America. Clin Infect Dis. 2019;68(10):e83–e110. https://doi.org/10.1093/cid/ciy1121

[3] Smaill FM, Vazquez JC. Antibiotics for asymptomatic bacteriuria in pregnancy. Cochrane Database Syst Rev. 2019;11:CD000490. https://doi.org/10.1002/14651858.CD000490.pub4

[4] Kazemier BM, Koningstein FN, Schneeberger C, et al. Maternal and neonatal consequences of treated and untreated asymptomatic bacteriuria in pregnancy: a prospective cohort study with an embedded randomised controlled trial. Lancet Infect Dis. 2015;15(11):1324–1333. https://doi.org/10.1016/S1473-3099(15)00070-5

[5] Donders GGG, Vereecken A, Bosmans E, Dekeersmaecker A, Salembier G, Spitz B. Definition of a type of abnormal vaginal flora that is distinct from bacterial vaginosis: aerobic vaginitis. BJOG. 2002;109(1):34–43. https://doi.org/10.1111/j.1471-0528.2002.00432.x

[6] Donders GGG, Bellen G, Rezeberga D. Aerobic vaginitis in pregnancy. BJOG. 2011;118(10):1163–1170. https://doi.org/10.1111/j.1471-0528.2011.03020.x

[7] Donders GGG, Ruban K, Bellen G. Selecting anti-microbial treatment of aerobic vaginitis. Curr Infect Dis Rep. 2015;17(5):477. https://doi.org/10.1007/s11908-015-0477-6

[8] Abd AM, Alrawi AM. Enterococcus faecalis as a Risk Factor in Aerobic Vaginitis among Pregnant Women. Rafidain J Sci. 2024;33(4):15-23. https://doi.org/10.33899/rjs.2024.185380

[9] Ejerssa AW, Gadisa DA, Orjino TA. Prevalence of bacterial uropathogens and their antimicrobial susceptibility patterns among pregnant women in Eastern Ethiopia: hospital-based cross-sectional study. BMC Womens Health. 2021;21(1):291. https://doi.org/10.1186/s12905-021-01439-6

[10] Chelkeba L, Fanta K, Mulugeta T, Melaku T. Bacterial profile and antimicrobial resistance patterns of common bacteria among pregnant women with bacteriuria in Ethiopia: a systematic review and meta-analysis. Arch Gynecol Obstet. 2022;306(3):663-686. https://doi.org/10.1007/s00404-021-06365-4

[11] Nahab HM, Al-Oebady MAH, Abdul Munem HA. Bacteriological study of urinary tract infections among pregnant women in Al Samawa City of Iraq. Arch Razi Inst. 2022;77(1):117–122. https://doi.org/10.22092/ARI.2021.356676.1889

[12] Khatatba LZ, Daraghmeh DN. Bacterial profiles, antibiotic resistance, and recurrence of UTIs during pregnancy: a prospective cohort study from Palestine. BMC Infect Dis. 2026. https://doi.org/10.1186/s12879-026-13978-0

[13] Barnawi Y, Alghamdi A, Ibrahim A, et al. Prevalence of urinary tract infections in pregnant women and antimicrobial resistance patterns in women in Riyadh, Saudi Arabia: a retrospective study. BMC Infect Dis. 2024;24:502. https://doi.org/10.1186/s12879-024-09385-y

[14] European Committee on Antimicrobial Susceptibility Testing. Clinical breakpoint tables. https://www.eucast.org/bacteria/clinical-breakpoints-and-interpretation/clinical-breakpoint-tables/

[15] Mason CY, Sobti A, Goodman AL. Staphylococcus aureus bacteriuria: implications and management. JAC Antimicrob Resist. 2023;5(1):dlac123. https://doi.org/10.1093/jacamr/dlac123

[16] Hindler JF, Stelling J. Analysis and presentation of cumulative antibiograms: a new consensus guideline from the Clinical and Laboratory Standards Institute. Clin Infect Dis. 2007;44(6):867–873. https://doi.org/10.1086/511864

[17] Magiorakos AP, Srinivasan A, Carey RB, et al. Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. Clin Microbiol Infect. 2012;18(3):268–281. https://doi.org/10.1111/j.1469-0691.2011.03570.x