International Scholars Journals

International Journal of Biochemistry and Biotechnology ISSN 2169-3048 Vol. 14 (2), pp. 001-003, February, 2025. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Review

Understanding Urine Cultures: Implications for Maternal Health in Pregnancy

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Accepted 06 December, 2024

Pregnancy is a risk factor for urinary tract infections. Asymptomatic bacteriuria is the most common type of urinary tract infections ranging between 4-7% and is a significant health risk in pregnancy. Although many different tests have been proposed, quantitative urine culture is still the gold standard method for asymptomatic bacteriuria and it should be performed in the first visit and at regular intervals during pregnancy. In this paper, we discuss the significance of urine culture versus other tests among pregnant women.

Keywords: urinary tract infection, pregnancy, culture.

INTRODUCTION

Pregnancy has been considered to be a factor predisposing to urinary tract infections (UTIs) for many years although differing opinions. Some authors advocate that pregnancy is an isolated situation and is not responsible for a higher incidence of urinary tract infections (Duarte et al., 2008). The anatomical and physiological changes in pregnancy such as diminished bladder tone, decreased ureteral peristalsis, dilatation of ureters and renal pelvis allow bacteria, mainly *Escherichia coli*, *Enterobacter*, *Klebsiella*, *Pseudomonas* and *Proteus* in bladder to ascend upper urinary tract (Banhidy et al., 2006).

UTI has been reported among 20% of the pregnant women and is the most common cause of hospital admission (Hamdan et al,. 2011). Significant risk factors for UTI in pregnancy have been found as a past history of UTI, sexual activity, lower socioeconomic status and multiparity (Haider et al,. 2010). The diagnosis of UTI is microbiological and based on two consecutive urine cultures presenting more than 10^5 CFU/mL urine of the same uropathogen (Duarte et al., 2008). Urinary tract infections have three different forms:

Asymptomatic bacteriuria (ASB).
Lower urinary tract infections (cystitis).
Upper urinary tract infections (pyelonephritis).

The differential diagnosis of UTI in pregnancy includes cervicitis, chlamydial genitourinary infections, nonbacterial cystitis, ectopic pregnancy, interstitial cystitis, nephrolithiasis, trichomoniasis, urethritis, vaginitis, glomerulonephritis, group B streptococcal colonization, sexually transmitted infection, threatened or incomplete miscarriage and urge incontinence. It should be noted that vaginal infections can cause or mimic UTIs and discrimination depends on vaginal and urinary cultures (Medscape) (2014).

Asymptomatic bacteriuria refers to persistant, actively multiplying same uropathogenmore than 10^5 CFU/mL in two consecutive urine cultures with no symptoms(Erdener et al,. 2000; Bayrak et al,. 2007). Its' prevalance in pregnancy varies from 2 to 15% depending on parity, race,

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socioeconomic status and region (Bayrak et al,.2007;Bilir et al,. 2013).Some studies reported that the risk of onset of bacteriuria is highest between 9^{th}-17^{th} gestational weeks in pregnancy (Stenqvist et al,. 1989). Recently, it is known that the risk of bacteriuria increases with duration of pregnancy (İnci et al,. 2011). Variousstudies show that *E.coli* is the most common causative organism, representing at least 80 % of isolates with other gram-negative rods and gram positive organisms such as *Staphylococcus saprophyticus*, *Enterococcus spp.* and group B streptococcus in ASB in pregnancy (Smaill 2007; Bayrak et al,. 2007). Group B streptococcus is related to premature rupture of membranes, preterm delivery, neonatal sepsis and meningitis (Majecko 2007). Development of acute and chronic pyelonephritisis the most important risk in pregnant women with ASB. Also, it is concluded that ASB is associated with preterm delivery and low birth weight (Mittendorf et al,. 1992).

Cystitis is defined as bacteriuria with inflammation of the bladder mucosa and symptoms such as hematuria, dysuria, suprapubic discomfort, frequency, urgency, and nocturia. Acute pyelonephritis is known as bacteriuria with inflammation of renal parenchyma, calices and renal pelvis accompanied by fever, flank pain, nausea and vomiting (İnci et al,. 2011). Pyelonephritis may develop in 15-50% of untreated ASB in pregnancy(Bilir et al,. 2013). Acute pyelonephritis in pregnancy is related to anemia, septicemia, transient renal dysfunction and pulmonary insufficiency (Bayrak et al,. 2007).

The gold standard method for the diagnosis of UTI in pregnant women has remained as the quantitative culture of urine and antibiotic susceptibility tests of isolated uropathogen(Jido 2014). The finalization of culture and antibiogram can take up to 48 hoursand this is a factor that force clinicians to search different diagnostic tests resulting earlier.

Tests Other Than Urine Culture

Recently, various tests are used for UTI in pregnancy. Commonly used urine screening tests for bacteriuria include direct microscopic examination, dipstick analysis of nitrite and leukocyte esterase, dip-slide test and enhanced urinalysis. Additionally, a new test method, serum procalcitonine level has been studied and reported as a significant test for ASB in pregnant women (Bilir et al,. 2013).The latter method requires further investigation for clinical use in ASB in pregnancy.

Urinary Interleukin-8 was investigated in a study and it is not recommended for detecting ASB in pregnancy (Shelton et al,. 2001).

After taking a midstream urine sample, examining sample for bacteria, red blood cells, white blood cells constitutes direct microscopic examination. It is rapid, inexpensive and requires little technical expertise. Its sensitivity for bacteriuria is 8.3-25 % (Smaill 2007). This is a non-specific test and doubtful of UTI if positive. Therefore, the presence of bacteriuria requires to be confirmed by urine culture (Feitosa et al,. 2009).

Dipstick test for leukocyte esterase and nitrites has a consistently low sensitivity. Sensitivity and specificity of dipstick test are not high enough to recommend it for detecting ASB/UTI (Kutlay et al,. 2003). Urine samples seen with leucocytes, blood and/or protein, they may need to be sent to the laboratory for further assessment. Some authors advocate that leucocyturia and positive nitrites in dipstick test indicate UTI and additional tests are not required (LatiniKeller et al,. 2009). The presence of nitrites in urine samples is more suggestive of bacterial infections buturine culture is requiredin general view (D'souza 2004).

The dip-slide test device is a plastic paddle coated with agar attached to a plastic cap screwing onto a sterile plastic vial (Mignini et al,. 2009). It contains a medium for bacterial growth and allows determining the concentration of colony forming units (CFU) in urine sample. The advantage of dip-slide test is directly culturing fresh urine sample and reducing potential overgrowth of commensal flora during transport to the laboratory. However, it is impossible to identify the causative uropathogen and perform antibiotic susceptibility test with this method. Therefore, traditional quantitative urine culture is needed.

Enhanced urinalysis is a method combining urine white blood cell count/mm^3 and Gram staining. Clinical significance of enhanced urinalysis is doubtful (Kaçmaz et al., 2006). It is remarkable that Gram staining of uncentrifuged urine has the best performance among rapid urine tests (Smaill 2007). Gram staining alone may be an alternative method to routine urinalysis for screening of ASB during pregnancy in clinical practice (Ullah et al,. 2012). It can be used in poor conditions inadequate for urine culture but cannot replace it (Ajayi et al,. 2010).

Urine Culture

In normal conditions, urine is sterile but may become contaminated during micturition with flora and epithelial cells from the vagina and urethra. Contamination of a urine sample can contribute to misdiagnosis of bacteriuria. It should be noted that bacteriuriamay occur due to colonization and contamination as well as infection (Kaçmaz et al., 2006).

It is known that sampling is a factor affecting quantitative urine culture results. There are three different types of sample collection for urine culture: midstream urine, midstream clean-catch urine sample and first concentrated urine sample in the morning. Catheterization should be performed if a difficulty in sample collection occurs. Present guidelines recommend to collect midstream urine sample for reducing risk of contamination (Schneeberger et al,. 2013). The definition of contamination is arbitrary and it

is showed that a more uniform definition of contamination is required. After sampling, appropriate transport urine sample to the laboratory and early processing are very important factors for culture. Samples kept at room temperature may have falsely elevated colony counts.

Two consecutive urine samples with isolation of the same uropathogen, at a colony count of 10^5CFU/ml or higher has been used to define a positive culture result. Counts lower than 10^5CFU/mL, with 2 or more organisms, usually indicate contamination rather than infection.

In pregnancy, some women have transient bacteriuria and obtaining a second urine culture for confirming persistent bacteriuria may limit antimicrobial exposure. Sometimes acquisition of bacteriuria later in pregnancy after initial negative culture result may be occur (Nicolle 2006). Therefore, urine culture should be performed more than one to avoid UTI in pregnancy.

Urine culture has advantages of identifying the causative uropathogen and performing antibiotic susceptibility tests. However, disadvantages of urine culture are being time-consuming, expensive and requiring technical expertise.Considering that other urine tests alone are not clinically relevant, interpreting quantitative urine culture with patients' condition (gestational week, predisposing factors such as underlying disease,etc.) is the most accurate method for detecting ASB and UTI in pregnancy.

REFERENCES

Ajayi AB, Nwabuisi C, Aboyeji PO, Fowotade A, Fakeye OO (2010). Reliability of urinemultistixand gram stain in thedetection of asymptomaticbacteriuria in pregnancy. West Afr J Med. 29(5): 339-343.

Banhidy F, Acs N, Puho EH, Czeizel AH (2006). Maternalurinarytractinfectionandrelateddrugtreatmentsduringpregnancy and risk of congenitalabnormalities in theoffspring. BJOG. 113: 1465-1471. (doi:10.1111/j.1471-0528.2006.01110.x)

Bayrak Ö, Çimentepe E, İnegöl İ, Atmaca AF, İltemirDuvan C, Koç A, Öztürk Turhan N (2007). Is single-dosefosfomycintrometamol a goodalternativeforasymptomaticbacteriuria in thesecondtrimester of pregnancy? IntUrogynecol J. 18:525–529. (doi: 10.1007/s00192-006-0190-y)

Bilir F, Akdemir N, Özden S, Cevrioğlu AS, Bilir C (2013). Increased serum procalcitoninlevels in pregnantpatientswithasymptomaticbacteriuria. ACMA. 12:25. (doi:10.1186/1476-0711-12-25)

D'souza Z, D'souza D (2004). Urinarytractinfectionduringpregnancy—dipstickurinalysis vs. cultureandsensitivity. J ObstetGynaecol. 24(1):22-24. (doi:10.1080/01443610310001620233)

Duarte G, Marcolin AC, Quintana SM, Cavalli RC (2008). Urinarytractinfection in pregnancy. Rev Bras Ginecol Obstet. 30(2):93-100.

Erdener O, Gürses AN, Çimen S (2000). İlk trimestre'deki gebelerde asemptomatikbakteriüri sıklığı. İstanbul Tıp Derg.1:35-37.

Feitosa DCA, Da Silva MG, De Lima Parada CMG (2009). Accuracy of simpleurinetestsfordiagnosis of urinarytractinfectıons in low-risk pregnantwomen. RevLatino-am Enfermagem . 17(4):507-513.

Haider G, Zehra N, Munir AA, Haider A (2010). Risk factors of urinarytractinfection in pregnancy. J Pak Med Assoc. 60(3):213-216.

Hamdan ZH, AbdelHaliem MZ, Salah KA, Ishag A (2011). Epidemiology of urinarytractinfectionsandantibioticssensitivityamongpregnantwomen at Khartoum North Hospital. Ann Clin Microbiol Antimicrob. 10:2. (doi:10.1186/1476-0711-10-2)

İnci M, İnci M, Davarcı M (2011). Gebelikte görülen üriner sistem enfeksiyonları ve tedavisi. TurkUrol Sem. 2:124-126. (doi:10.5152/tus.2011.23)

Jido TA (2014). Urinarytractinfections in pregnancy: evaluation of diagnosticframework. Saudi J KidneyDisTranspl. 25(1):85-90.

Johnson EK, WolfJr JS, Kim ED. Urinarytractinfections in pregnancy. See http://emedicine.medscape.com/article/452604-overview (accessed 26 November 2014).

Kaçmaz B, Çakır Ö, Aksoy A, Biri A (2006). Evaluation of rapid urine screening tests to detect asymptomatic bacteriuria in pregnancy. Jpn J InfectDis. 59:261-263.

Kutlay S, Kutlay B, Karaahmetoglu O, Ak C, Erkaya S (2003). Prevalence, detection and treatment of asymptomatic bacteriuria in a Turkish obstetric population. J ReprodMed. 48(8):627-630.

Latini Keller V, Junod PN, Graf JD, Stoermann CC (2009). Urinalysis: what a primary care physician needs to know. Rev Med Suisse. 23;5(218):1870-1875.

Majecko AM, Schaeffer AJ (2007). Asymptomatic bacteriuria and symptomatic urinary tract infections during pregnancy. UrolClin N Am 34: 35–42.

Mignini L, Carroli G, Abalos E, Widmer M, Amigot S, Nardin JM, Giordano D, Merialdi M, Arciero G, Del CarmenHourquescos M (2009). Accuracy of diagnostic tests to detect a symptomatic bacteriuria during pregnancy. Obstet Gynecol. 113:346–352.

Mittendorf R, Williams MA, Kass EH (1992). Prevention of preterm delivery and low birth weight associated with a symptomatic bacteriuria. ClinIn fect Dis. 14(4):927-932.

Nicolle LE (2006). Asymptomaticbacteriuria: review and discussion of the IDSA guidelines. Int J of Antimicrob Agents. 28:42–48.

Schneeberger C, Van den Heuvel ER, Erwich JJHM, Stolk RP, Visser CE, Geerlings SE (2013). Contamination rates of three urine-sampling methods to assess bacteriuria in pregnant women. Obstet Gynecol. 121:299–305. (doi: http://10.1097/AOG.0b013e31827e8cfe)

Shelton SD, Boggess KA, Kırvan K, Sedor F, Herbert WNP (2001). Urinary Interleukin-8 with a symptomatic bacteriuria in pregnancy. Obstet Gynecol. 97:583–586.

Smaill F (2007). Asymptomatic bacteriuria in pregnancy. Best PractResClinObstet Gynaecol. 21(3):439–450. (doi:10.1016/j.bpobgyn.2007.01.004)

Stenqvist K, Dahlén-Nilsson I, Lidin-Janson G, Lincoln K, Odén A, Rignell S, Svanborg-Edén C (1989). Bacteriuria in pregnancy. Frequency and risk of acquisition. Am J Epidemiol. 129(2):372-379.

Ullah A, Barman A, Ahmed I, Salam A (2012). Asymptomaticbacteriuria in pregnant mothers: a valid and cost-effective screening test in Bangladesh. J Obstet Gynaecol. 32(1):37-41. (doi: 10.3109/01443615.2011.601697).

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