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Asymptomatic bacteriuria screened by catheterized samples at pregnancy term in women undergoing cesarean delivery

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Summary

Objective: The objective of this study was to assess the frequency of urinary tract infection (UTI) with urine samples obtained via catheterization among women undergoing cesarean delivery at term pregnancy. *Materials and Methods:* A cross-sectional study involving 159 women in whom cesarean delivery was conducted at term pregnancy after a regular follow-up from first to third trimester. For screening and diagnosis of UTI during antenatal period, the authors used dipstick test and microscopic urinalysis, and urine culture was used in the presence of symptomatic UTI unresponsive to initial antibiotic therapy. A urine sample was obtained immediately after insertion of Foley catheter for urine dipstick test, microscopic urinalysis, and culture during cesarean delivery. Obstetric and UTI data were recorded. *Results:* Of 159 pregnant women, 95 (59.8%) did not develop UTI during antenatal care. There was no patient with symptomatic UTI at the admission for cesarean delivery. The authors found UTI with urine dipstick and microscopic urinalysis in 12 patients and of them, four patients had no history of UTI, and all the remaining eight patients had asymptomatic UTI during antenatal follow-up. UTI according to urine culture was encountered in three patients, two of them had one episode of UTI, and one had two episodes of UTI during antenatal follow-up. *Conclusions:* After regular antenatal follow-up screening with urine dipstick, microscopic urinalysis, and counseling of pregnant women regarding UTIs, the frequency of bacteriuria decreases considerably during cesarean delivery.

Key words: Asymptomatic bacteriuria; Pregnancy; Cesarean delivery.

Introduction

Detection of bacteria in the urine of a person without clinical findings of urinary tract infection (UTI) is defined as asymptomatic bacteriuria. Although the prevalence of asymptomatic bacteriuria (from 2% to 7%) in pregnant and non-pregnant women is comparable, this condition gains importance in pregnancy since it may increase the incidence of symptomatic bacteriuria and perinatal complications such as prematurity and intrauterine growth restriction. The causative organisms (generally E. coli) and their entry mechanisms are likely to be the same for both groups. Symptomatic bacteriuria is defined either as lower urinary tract (acute cystitis) or upper urinary tract (acute pyelonephritis) infection [1-6].

Anatomical and functional changes in the urinary tract in pregnancy can increase susceptibility to progression of the infection from asymptomatic bacteriuria to the stage of cystitis and even to acute pyelonephritis. The upper urinary tract shows dilatation as early as the first trimester of pregnancy and the bladder itself is displaced superiorly and anteriorly with the enlarging uterus [7]. Mechanical compression caused by enlarged uterus is the principle cause of hydroureter and hydronephrosis especially in the second and third trimesters; however, smooth muscle relaxation related to increased progesterone has also an important role. Smooth muscle relaxation decreases peristalsis of the ureters, increases bladder capacity, and causes urinary stasis. Changes in urine pH and osmolality and pregnancy-induced glycosuria and aminoaciduria are accepted as other factors facilitating bacterial growth leading to urinary infection [8].

During pregnancy, screening and treatment for asymptomatic bacteriuria are included in the standard obstetric care in many antenatal care centers and most antenatal guidelines require the routine screening for asymptomatic bacteriuria [1, 5, 9-12]. The main types of urine testing evaluated for the diagnosis of UTI were dipstick test and microscopic urinalysis. Dipstick tests have the advantage of providing an immediate result, and of being both cheap and easy to perform and interpret. Urine culture is generally considered to be the reference standard for UTI diagnosis; however, its duration of approximately 48 hours to give a result and higher cost are accepted as drawbacks [13]. A single urine specimen obtained from 12-16 weeks of pregnancy will identify most women with asymptomatic bacteriuria. According to suggestions of U.S. Preventive Services Task Force, all pregnant women should provide a clean-catch urine specimen for a screening culture at 12 to 16 weeks' gestation or at the first prenatal visit, if later; however, the optimal frequency of subsequent urine testing during pregnancy is uncertain [14].

Although UTIs are accepted as important medical complications in pregnancy, several questions concerning this

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subject remain controversial and have become a motive for clinical studies [15-17]. In routine clinical practice, clean-catch midstream specimen is the best non-invasive method of urine collection. Catheterization or suprapubic bladder aspiration is rarely used because of their invasiveness. As with any type of laboratory specimen, there are certain criteria that need to be met for proper collection of urine that should be collected and processed with as little contamination as possible. Technically satisfactory collection of urine from women especially in the late stages of pregnancy can be difficult [18]. According to the authors' knowledge, there is no study assessing the frequency of bacteriuria diagnosed with a urine specimen obtained via urinary catheterization before cesarean operation and evaluating its association with antenatal bacteriuria data, and investigating its contribution to infectious morbidity after cesarean delivery. The objectives of this study were to assess the frequency of asymptomatic bacteriuria with urine samples obtained via catheterization among women undergoing cesarean delivery at term pregnancy, after screening for bacteriuria during antenatal period, and to investigate its relationship with UTI during antenatal period and after cesarean delivery.

Materials and Methods

A cross-sectional study was carried out at the antenatal clinic of the present hospital involving 159 women in whom cesarean delivery was performed at term pregnancy between January and October in 2012. Pregnant women receiving all antenatal care beginning in the first trimester in the antenatal clinic according to our Protocol for Antenatal Care were included in this study. The patients were excluded if they had any signs or symptoms of UTI or if they had used antibiotics during the last two weeks on at first antenatal visit. Women with underlying renal pathology, abnormality, or obstruction and with a history of chronic renal disease, recurrent urinary tract infection, renal transplant, diabetes, anemia, preterm labor, or taking immunosuppressive therapy were excluded. The authors also excluded women with long duration of surgery (>two hours) due to complications during cesarean delivery or women in whom bladder injury was developed. During study period, selected obstetric and UTI data of 159 pregnant women for their antenatal and postpartum periods were collected from patient records. The study was approved by the Human Ethical Research Committee of the authors' University.

Screening and management of urinary tract infection

During antenatal follow-up, all the women underwent screening of UTI with analyses of urine at the first and subsequent antenatal visits. Patients were requested to give midstream urine samples in sterile containers after cleaning the urethral entrance after a standard instruction [18]. To minimize the risk of contamination, the women were counseled regarding the method of cleaning the urethral meatus, and then collecting about ten ml of urine as mid-stream (without decreasing the urine flow to start or stop the collection) into a sterile container.

For screening and diagnosis of UTI during antenatal period, the authors used dipstick test and microscopic urinalysis, and urine culture was used in the presence of symptomatic UTI unresponsive to initial antibiotic therapy. In case of asymptomatic and symptomatic UTI, fosfomycin (first-line) or a second-generation cephalosporin (second-line) were administered and dipstick test and microscopic urinalysis were repeated one week later after completion of treatment. Screening was continued for asymptomatic bacteriuria at each subsequent visit after completing antibiotic treatment.

Lower UTI was defined as the following criteria: symptomatic UTI as a clinical picture including frequent urination, pain in the bladder area, dysuria with positive urinary tests, asymptomatic UTI as positive urine tests without any symptoms, and signs of UTI.

In all cesarean deliveries before beginning of surgery, the authors used a Foley catheter to empty the bladder for increased space in the pelvic cavity to protect the bladder during surgery and it was removed eight hours later after surgery. A urine sample was obtained immediately after insertion of Foley catheter for urine dipstick test, microscopic urinalysis, and culture.

Urinary analysis

All urine samples were immediately transferred and processed within one hour of collection in the laboratory. For urine dipstick test (SD Urocolor ten reagent strips for urinalysis), the stick was quickly dipped into the urine, waited for 60 seconds, and then read at the correct time interval as specified on the container. It was considered as positive if it was positive for nitrite, or both the dipstick leucocyte esterase and blood, or for all three. In microscopic urinalysis, samples were centrifuged at 2,000 rpms for five minutes, and sediments were examined microscopically to determine the percentage of leukocytes and bacteria. Microscopy was accepted as positive if there were > five leucocytes per high-power field or 15 bacteria per high-power field in centrifuged urine sediment.

During urine culture, samples were inoculated on blood agar and eosin-methylene blue agar in 30 minutes. Samples with 10^5 cfu/ml or more growth at 18–24 hours of incubation were examined macroscopically. Samples with no growth at this time point were re-incubated for another 24 hours. Identification and antimicrobial susceptibility testing was performed in accordance with M2-A9 standards and the Clinical and Laboratory Standards Institute Quality Manual [19]. Clinical data was abstracted from hospital records and presented as median (min-max) or percentage.

Results

During the study period, selected obstetric and UTI data of 159 patients were collected (Table 1). With the setting of this study in all women with cesarean birth at term pregnancy after regular follow-up from at the first to third trimester, there was no perinatal complication or outcome after regular antenatal care related to UTI.

Table 2 shows the results of laboratory work-up including urine dipstick and microscopic urinalysis during the antenatal follow-up of study population. Repeated UTIs were encountered in the first, second, and third trimesters in an increasing order (as second episode in first trimester (3.1%), as second episode in second trimester (6.9%), as second, and third episodes in third trimester (8.2% and 5.0%, respectively). Symptomatic UTI episodes were developed in 9 (5.7%) of the study population and in seven (4.4%) of them, urine culture was performed. Of 159 preg-

Table 1. — *Obstetric data of pregnant women undergoing cesarean delivery.*

Characteristics	Patients (n=159)
Age, years	29 (23-41)
Nulliparous	92 (57.9%)
History of symptomatic UTI	
Previous pregnancies	9 (%5.7)
Before pregnancy	4 (0%)
Cesarean indications	
Repeat cesarean	71 (44.6%)
Fetal factors	64 (40.3%)
Maternal factors	24 (15.1%)
Type of anesthesia	
General	52 (32.7%)
Regional	107 (67.3%)
Maternal weight	
At first visit	53 (48-73)
At cesarean delivery	60 (58-81)
Maternal hemoglobin (g/dl)	
At first visit	12 (10-16)
At cesarean delivery	11 (10-14)
The length of hospital stay for cesarean delivery (d)	2 (2-3)
At cesarean delivery	
Gestational age	39 (37-42)
Newborn weight	3550 (3100-4250)
Perinatal complication related to UTI	0 (0%)
Adverse perinatal outcome related to UTI	0 (0%)

Data are presented as median (min-max) or percentage as appropriate.

Table 2. — *Episodes of asymptomatic urinary tract infection during antenatal follow-up of study population.*

Urinary tract infection[a]	Gestational age (weeks)	Antenatal follow-up (n=159)	
		Positive (n, %)	Negative (n, %)
First episode			
First trimester	8 (6-14)	29 (18.2%)	130 (81.8%)
Second trimester	22 (19-25)	22 (13.8%)	137 (86.2%)
Third trimester	33 (32-35)	13 (8.2%)	146 (91.8%)
Total		64 (40.2%)	95 (59.8%)
Second episode			
First trimester[b]	12 (11-13)	5 (3.1%)	155 (96.9%)
Second trimester[c]	20 (15-27)	11 (6.9%)	148 (93.1%)
Third trimester[d]	31 (29-34)	13 (8.2%)	141 (91.8%)
Total		29 (18.2%)	130 (81.8%)
Third episode			
Third trimester[e]	33 (28-39)	8 (5.0%)	151 (95%)

[a]Diagnosed with the positivity of urine dipstick and microscopic urinalysis together. [b]Symptomatic urinary tract infection developed in one patient. [c]Symptomatic urinary tract infection developed in two patients, urine culture was required in two of them. [d]Symptomatic urinary tract infection was developed in four patients, urine culture was required in three of them. [e]Symptomatic urinary tract infection was developed in two patients, urine culture was required in two of them. Gestational age are presented as median (min-max).

Table 3. — *Positivity of urinary infection tests at cesarean delivery according to urinary data of antenatal care.*

Urinary tract infection at antenatal care	At cesarean delivery (n=159)	
	Urine dipstick and microscopic urinalysis	Urine culture
No infection, n	4	0
First episode, n	0	1
	3	0
	3	1
Second episode, n	0	1
Third episode, n	2	0
Total	12	3

nant women, 95 (59.8%) did not developed UTI during antenatal care.

Table 3 presents results of laboratory work-up for asymptomatic UTI at cesarean delivery according to the results of screening for UTI. There was no patient with symptomatic UTI at the admission for cesarean delivery. The authors found UTI with urine dipstick and microscopic urinalysis in 12 patients and of them, four patients had no history of UTI and all the remaining eight patients had asymptomatic UTI during antenatal follow-up. UTI according to urine culture was encountered in three patients, two of them had one episode of UTI, and one had two episodes of UTI during antenatal follow-up. It was not possible to draw conclusions with statistical analyses about correlation of results of urine dipstick and microscopic urinalysis with urine culture because of small number of patients. There were no postpartum UTI in any of the study subjects.

Discussion

Of 159 pregnant women, 95 (59.8%) did not developed UTI during antenatal care and 64 had asymptomatic or symptomatic UTI. Symptomatic UTI episodes developed in nine (5.7%) of the study population and in seven (4.4%) of them, urine culture was used. There were no patients with symptomatic UTI with the assessment of clinical and laboratory data related to UTI before and within three days after cesarean section. With urine dipstick and microscopic urinalysis, there were 12 patients with asymptomatic UTI and of these patients, four had no history of UTI during antenatal period, and all the remaining eight patients had asymptomatic UTI during antenatal follow-up. UTI was diagnosed with urine culture in three patients, two of them had one episode of UTI, and one had two episodes of UTI during antenatal follow-up. Because of the small number of patients with positive urine culture at cesarean delivery, clinical and UTI data were not statistically analyzed. There were no postpartum UTIs in any of the study subjects. Overall, with followed strategy for the diagnosis and management of UTI during antenatal period, the authors thought that the number of patients with asymptomatic UTI were reduced

during antenatal period and at cesarean delivery. It was not possible to draw conclusions about correlation of results of urine dipstick and microscopic urinalysis with urine culture because of small number of patients.

After evaluation of perinatal outcome, the authors found no adverse result related to UTI in the antenatal period. Overall, they suggest that screening and management of UTI during antenatal follow up and patient information regarding UTI successfully decrease the rate of UTI before delivery and prevent complications resulting in bad perinatal outcomes. Generally, it is a goal to carry out surgical and anesthetic procedures to improve patient recovery and outcome. Stray-Pedersen *et al.* [20] assessed the status of postpartum bacteriuria in about 11,000 women by culture of voided midstream urine and detected UTI in about 8% of them. They performed the urine culture again with urine samples obtained by suprapubic aspiration. They could confirm UTI in about half of the patients in whom the first culture was found as positive. Overall, they concluded that confirmed bacteriuria was detected in 3.2% of puerperal women. They found that operative delivery as cesarean section, forceps and vacuum extractor delivery, epidural anesthesia, and bladder catheterization could be considered risk factors for bacteriuria in the postpartum period.

A clean voided specimen with cleansing of the perineum and urethra is standard [21]. False-positive urine culture results are common due to contamination of the urine sample. The laboratory can suspect the possibility of contamination when there are many epithelial cells, multiple organisms, or bacteria but no leucocytes. However, a study of 100 adolescent pregnant women found perineal cleansing before midstream urine did not decrease bacterial contamination of the urine cultures [22]. During cesarean delivery, the present authors obtained the urine samples from urethral catheterization that was a routine procedure before surgery. Any form of catheterization can also potentially introduce micro-organisms and hence cause UTI in addition to being traumatic procedure. They carried out catheterization procedure in a standard manner to prevent introducing microorganisms to bladder. High number of patients with asymptomatic UTI at first visit may be related to difficulty of obtaining midstream urine samples by women; nevertheless, if the difficulties and complications of invasive urine sampling techniques were considered, midstream urine sampling could be a good option for evaluation of UTI.

The conventional and classical method for the detection of Asymptomatic bacteriuria (ASB) is urine testing with culture [23] Although urine culture is the gold standard for ASB detection, it may not be applicable to all of the pregnant women when we consider that most of the deliveries occur in non-developed or developing regions of the globe. It is also time-consuming and requires an established microbiology laboratory [24]. Since simplicity and low cost is required for a test to be used as a universal screening tool, some other methods are investigated for the detection of ASB in pregnant women. Urine dipstick tests are easy to perform and give immediate result without a need of a laboratory. Although, the prediction value for ASB of this however has been reported to be conflicting [25], a recent meta-analysis that included studies of pregnant women concluded that negative results could rule out UTIs in asymptomatic pregnant women. On the other hand simple urine test solely is not recommended as a screening tool for ASB in pregnancy since it has low sensitivity [26, 27]. During enhanced urinalysis, uncentrifuged urine was tested with Gram-staining for bacteria and leukocyte counting with hemocytometer [28]. Kacmaz *et al.* [29] compared the results of leukocyte esterase and nitrite urine dipstick tests with enhanced urinalysis and urine culture. They concluded that enhanced urinalysis did not provide additional advantage for detecting asymptomatic bacteriuria. In their study, leukocyte esterase, nitrite, and enhanced urinalysis had a sensitivity of 70%, 60%, and 50% with a specificity of more than 92%.

This study has some limitations. First, it was a single-site investigation and these results may not be applicable to other settings. Second, it had a small number of patients with UTI at cesarean delivery, not suitable for statistical analyses. Further studies may be helpful to assess the association of UTIs diagnosed at third trimester with UTIs diagnosed with urine specimens obtained by urine catheter at cesarean delivery. It may also be considered to carry out a further study to assess the frequency of UTIs with urine specimens obtained as mid-stream urine sample or urine sample with a catheter; this may help to understand the efficacy of protocols for urine sampling during pregnancy.

The first clinical implication of the present findings is that the follow-up of pregnant women with urine dipstick and microscopic urinalysis during antenatal period may provide an easy and effective approach to reduce the number of UTI episodes and perinatal morbidities related to UTIs. The addition of fosfomycin or a second-generation cephalosporin for the empirical treatment of UTIs may be considered as a considerably successful therapy protocol. This strategy may have a potential to reduce complications related to UTIs in women undergone cesarean delivery. Physicians need to keep in mind that the presence of bacteria in urine as a sole finding may not necessarily have a clinical value. It can be a result of colonization or contamination, as well as due to infection in the urinary tract. During antenatal care, provided that physicians conformed to a standard protocol for diagnosis and treatment of UTIs in pregnant women during regular follow-up, the episodes of asymptomatic or symptomatic UTIs and their complications may be decreased with an improvement in maternal and perinatal morbidities.

In conclusion, during antenatal follow-up, screening with urine dipstick and microscopic urinalysis and counseling of

pregnant women regarding UTIs are considerably successful in order to prevent complications of UTIs and adverse perinatal outcomes. The addition of empirical treatment of UTIs with fosfomycin or a second-generation cephalosporin may be a good strategy. As demonstrated by urine culture during cesarean delivery, overall, the study protocol may lower the rate of asymptomatic bacteriuria at the time of delivery and prevents postoperative UTI after surgery.

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