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## OBSTETRICS

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# Evaluation of the urinalysis and reagent strip testing to screen asymptomatic bacteriuria in pregnancy

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## ABSTRACT

**Objective** To evaluate the diagnostic performance of the urinalysis and reagent strip testing as a screening test for asymptomatic bacteriuria (ABU) in pregnant patients.

**Study design** Diagnostic test.

**Material and Methods** A clean-catch midstream urine specimen was evaluated in each of 392 pregnant patients at the initial prenatal visit from January to June 2001. Simple urinalysis and reagent strip tests were performed on all subjects. The presence of 5 WBC/HPF of centrifuged urine indicated a positive test for urinalysis, and the presence of either nitrites or leukocyte esterase activity indicated a positive test for reagent strip test. ABU was defined as the presence of  $10^5$  colony forming units of single bacteria per milliliter of urine. Sensitivity, specificity, positive predictive value, and negative predictive value of the tests were calculated by using urine culture as a gold standard.

**Results** The prevalence of ABU was 6.1%. The sensitivity and specificity of testing by urinalysis were 41.7% and 68.5%, respectively. The reagent strip test offered a sensitivity of 66.7% and a specificity of 51%. Combination of tests either in series or in parallel did not help improve sensitivity over one of each.

**Conclusion** Neither test offers good sensitivity. Taken together with the potential sequelae of undiagnosed ABU, it is recommended that urine cultures should be used for all pregnant patients to detect ABU.

**Key words:** Asymptomatic bacteriuria, Pregnancy, Urinalysis, Reagent strip test

Asymptomatic bacteriuria (ABU) has been found in 6 – 11 % of pregnant women.<sup>(1-4)</sup> According to the physiologic changes in pregnancy that increase urinary static condition, acute pyelonephritis will develop in 14 – 57 % of untreated pregnant patients with ABU.<sup>(4)</sup> Furthermore, ABU is associated with preterm delivery and low birth weight infant.<sup>(2,4,5)</sup> Given the fact that

identification and eradication of ABU in pregnant patients can lower the likelihood of ascending infection and prevent preterm delivery, every pregnant patient should be screened for ABU and given appropriate treatment. It has been demonstrated that to treat ABU in pregnancy decreases the rate of subsequent pyelonephritis by 80 – 90 %.<sup>(6,7)</sup> Routine urine culture

for all pregnant patients is therefore recommended as the standard management.<sup>(2,8)</sup> However, the presence of white blood cells on urinalysis has been used instead of urine culture to screen ABU in many places including Thammasat University hospital because of the high cost of urine culture to the patients. Urine culture is limited to definitive diagnosis of ABU after positive screening by urinalysis. Urine reagent dipstick testing is rapid and inexpensive and requires little technical expertise. A broad range of sensitivity (47 – 92 %) of reagent strip tests has been reported.<sup>(9-13)</sup> In Thammasat University hospital, we also use reagent strip testing in parallel with urinalysis to increase sensitivity of urinalysis. From previous reports, many studies did not support the concept that urinalysis and/or reagent strip test were proper as being a screening test for ABU.<sup>(11,13,14)</sup> The present study was thus to evaluate the diagnostic performance of urinalysis, reagent strip test, and the combinations of the tests in screening ABU in pregnancy.

## Material and methods

This cross sectional study was conducted from January to June 2001 at the antenatal care clinic, Thammasat University hospital, with the approval from the institutional review board under the grant of Faculty of Medicine, Thammasat University. We recruited all pregnant patients who attended their initial antenatal care sessions everyday during the period of study except for the patients who met the exclusion criteria. The exclusion criteria were 1). Patients who had symptomatic urinary tract infection, and 2). Patients who had received any antibiotics during the prior 14 days. After explaining the objective of the study and obtaining the informed consent, the well-trained staff nurse explained how to collect the clean-catch midstream urine sample into a sterile container to every patient. The specimens were taken to the microbiology laboratory for processing within 30 minutes.

Microscopic diagnosis was performed on sediment from centrifuged urine samples. We used 10 milliliters of urine to be centrifuged at 3000 rpm for 5 minutes. A count of 5 leukocytes per high power field

was considered a positive finding. A separate sample of urine was tested by reagent strips according to the manufacturer's instruction. The presence of either nitrites or leukocyte esterase activity was considered positive. Urine cultures were plated immediately on receipt in the laboratory using blood and MacConkey agar with a 0.001-ml loop. The plates were aerobically incubated at 35°C-37°C for 24-48 hours. ABU was defined as the presence of  $10^5$  colony forming units of single bacteria per milliliter of urine.

Sample size was calculated by using the expected sensitivity of the test from the previous report with 10% acceptable error under the existent prevalence of ABU in the present study obtained from the pilot study (6%). Altogether, number of samples should be 380 or more. After exclusion of pregnant patients who fitted the exclusion criteria, we firstly recruited 400 pregnant patients into the study. Eight patients were again excluded because either urinalysis, reagent strip test, or urine culture was not performed, or the patient's information was incomplete. The data were analyzed by the standard analysis of diagnostic test, and the  $\chi^2$  test was used at where appropriate.

## Results

The mean age ( $\pm$  S.D.) of patients was 26.6  $\pm$  5.7 years (range 14 – 44 years). The majority of patients were manual workers (56.6%), the rest were housewives, business women, civil servants, and agriculturists, respectively. Most patients (49.0%) had finished high school education, the rest of them graduated at primary school level, bachelor degree, and above bachelor degree, respectively. The patients mostly earned between 5001 – 10000 baht per month (34.2%), 26 % of them earned only 5000 baht or less per month. Median of the gravidity of the study population was 2 and median of the parity was 1. Seventy point nine percent of patients attended their initial visit in first trimester of pregnancy, 27 % were in second trimester, and the rest were in third trimester. Information on history associated with urinary tract infection is shown in Table 1.

The prevalence rate of ABU in the present study

was 6.1 %. The two most common organisms responsible for ABU in the present study were *Staphylococcus coagulase-negative* (58.3%) and *E. coli* (25.0%), respectively. Sensitivity, specificity, positive

predictive value, negative predictive value, and accuracy of the urinalysis, reagent strip test, and combinations of the tests (in series and in parallel) are shown in Table 2.

**Table 1.** History associated with urinary tract infection

	Positive history		Negative history		$\chi^2$ test
	number	percent	number	percent	
History of urinary tract infection	36	9.2	356	90.8	P=0.916
History of urinary calculi	12	3.1	380	96.9	P=0.005*
History of urinary tract anomaly	2	0.5	390	99.5	P=0.798

\*P < 0.05 was considered statistically significant

**Table 2.** Diagnostic performance of the tests in screening ABU

	Sensitivity(%)	Specificity(%)	PPV* (%)	NPV** (%)	Accuracy (%)
Urinalysis	41.7	68.5	7.9	94.7	66.8
Reagent strip test	66.7	51.0	8.0	95.9	52.0
Combination in series	41.7	71.7	8.8	94.9	69.9
Combination in parallel	66.7	47.8	7.7	95.7	49.0

\*PPV = positive predictive value, \*\*NPV = negative predictive value

## Discussion

The prevalence rate of 6.1% of ABU in our population is similar to previously reported rates.<sup>(4,8)</sup> The most common causative organism for ABU in the present study was *Staphylococcus coagulase-negative*. It is correlated with the results from the northeastern and the southern regions of Thailand.<sup>(14,15)</sup> However, it is generally known that *E. coli* is the most common pathogen responsible for ABU.<sup>(8)</sup>

It was recently reported that antepartum urinary tract infection before prenatal care and prepregnancy history of urinary tract infection were the two strongest predictors of bacteriuria at prenatal care initiation.<sup>(16)</sup> We could not find significant association between history of urinary tract infection and ABU in our population, but we found that history of urinary calculi was associated with ABU (Table 1).

Urinalysis has a low sensitivity (41.7%) to detect ABU in pregnant patients in the present study. Urinalysis has been reported with varying sensitivity from 18.4%<sup>(14)</sup>, 28%<sup>(17)</sup>, 80.6%<sup>(13)</sup>, and 83%.<sup>(18)</sup> Meanwhile, board range of sensitivity (47 – 92 %) of reagent strip test has been reported.<sup>(9-13)</sup> In our study, the reagent strip test offers better sensitivity than urinalysis (66.7% versus 41.7%), however, it is not good enough to be a screening test. Combination of the tests in series was performed in order to improve specificity. It offers slight improvement in specificity with the same sensitivity as that of urinalysis (Table 2). As sensitivity is more important for a screening test, combination of the tests in parallel was performed in expectation of improving sensitivity. However, sensitivity seems not to be good enough to make this a proper screening test for ABU (Table 2). Regarding the limitation of the

urinalysis and reagent strip test to detect ABU and regarding to the potential sequelae of undiagnosed ABU in pregnancy, we recommend that urine culture should be routinely performed in all pregnant patients at their first antenatal visit to detect ABU.

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