Screening for Asymptomatic Bacteriuria in Pregnant Women : Urinalysis *Versus* Urine Culture

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Abstract

A diagnostic test study was conducted to evaluate the diagnostic performance of a simple urinalysis as a screening test for asymptomatic bacteriuria (ABU) in pregnant women. Seven hundred and seventy four asymptomatic pregnant women attending their first antenatal care at Srinagarind Hospital from June 1, 1994 to January 31, 1995 were studied. Simple urinalysis and urine culture were performed on all 774 subjects. The presence of $\geq$ 5 WBC/HPF of centrifuged urine indicated a positive test. ABU was defined as the presence of $\geq 10^5$ colony forming units of single bacteria per milliliter of urine. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of simple urinalysis in detecting ABU, using urine culture as a gold standard were calculated. Simple urinalysis had a 18.4 per cent sensitivity, 97.2 per cent specificity, 45.7 per cent positive predictive value, 90.4 per cent negative predictive value and 88.4 per cent accuracy in detecting ABU. Because of its low sensitivity and the possible consequences of ABU, simple urinalysis should not be used as a screening test for ABU.

Key word : Screening, Urinalysis, Urine Culture, Asymptomatic Bacteriuria, Pregnancy

Asymptomatic bacteriuria (ABU) is defined as the presence of $\geq 10^5$ colony forming units of single type of bacteria per milliliter of urine detected by mid stream urine culture in asymptomatic patients[1-3]. Without appropriate management 20 to 40 per cent of pregnant women with ABU will develop acute pyelonephritis later on during pregnancy[4-6]. This acute pyelonephritis is a risk factor for preterm delivery and low birth weight[4,7]. Accurate diagnosis of ABU in pregnant women is very crucial in preventing its serious consequences. Routine urine culture for all pregnant women is recommended as the standard management[1,8]. This is quite costly and not readily avai-

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lable in many parts of the world. Simple urinalysis by looking for the presence of white blood cells has been used as a screening test for ABU for many years and is still being used in many settings including Srinagarind Hospital, Khon Kaen University. The diagnostic performance of this simple urinalysis as a screening test for ABU is still conflicting[9-11]. Therefore, this study was conducted to assess the diagnostic performance of simple urinalysis as a screening test for ABU.

MATERIAL AND METHOD

All pregnant women who attended their first antenatal care at Srinagarind Hospital, Khon Kaen University from June 1, 1994 to January 31, 1995 were eligible for the study. We excluded those subjects with symptomatic urinary tract infection and those who had received any antibiotics during the past 7 days. There were 774 subjects recruited in this study. After explaining the objective of the study and obtaining the informed consent, sociodemographic and obstetric information were collected and routine standard antenatal care was given. Every subject who agreed to participate in the study received detailed instruction on how to collect the clean-catch midstream urine sample into a sterile container. The urine samples were sent to the laboratory for simple urinalysis and urine culture within one hour of collection.

Ten milliliters of urine was centrifuged at 3000 round per minute for 5 minutes. The presence of $\geq$ 5 white blood cells (WBC) per high power field (HPF) indicated a positive test. Urine culture was performed using blood and MacConkey agar incubating at 35°-37°C for 24 to 48 hours. The presence of $\geq 10^5$ colony forming units of a single type of bacteria per milliliter of urine indicated bacteriuria. If $\geq 10^5$ colony forming units of 2 or more types of bacteria were detected, contamination was interpreted and urine culture was repeated within 2 weeks. Subjects with ABU were treated with appropriate antibiotics. A standard analysis for diagnostic test was performed. This study was approved by the ethical committee of the Faculty of Medicine, Khon Kaen University.

Table 1. Diagnostic performance of simple urinalysis in detecting ABU in pregnant women using urine culture as a gold standard.

		Urine culture		
		+	-	Total
Simple urinalysis	+	16	19	35
	-	71	668	739
	Total	87	687	774

$$\text{Sensitivity} = \frac{16 \times 100}{87} = 18.4\ \%$$

$$\text{Specificity} = \frac{668 \times 100}{687} = 97.2\ \%$$

$$\text{Positive PV} = \frac{16 \times 100}{35} = 45.7\ \%$$

$$\text{Negative PV} = \frac{668 \times 100}{739} = 90.4\ \%$$

$$\text{Accuracy} = \frac{(16 + 668) \times 100}{774} = 88.4\ \%$$

$$\text{Prevalence} = \frac{87 \times 100}{774} = 11.2\ \%$$

Table 2. Diagnostic performance of simple urinalysis in detecting ABU with varying criteria for positive test.

Criteria for positive test	Sensitivity (%)	Specificity (%)	Positive PV (%)	Negative PV (%)	Accuracy (%)
≥ 5 WBC/HPF	18.4	97.2	45.7	90.4	88.4
3 - 4 WBC/HPF	20.7	94.0	30.5	90.4	85.8
1 - 2 WBC/HPF	78.2	42.2	14.6	93.9	46.3

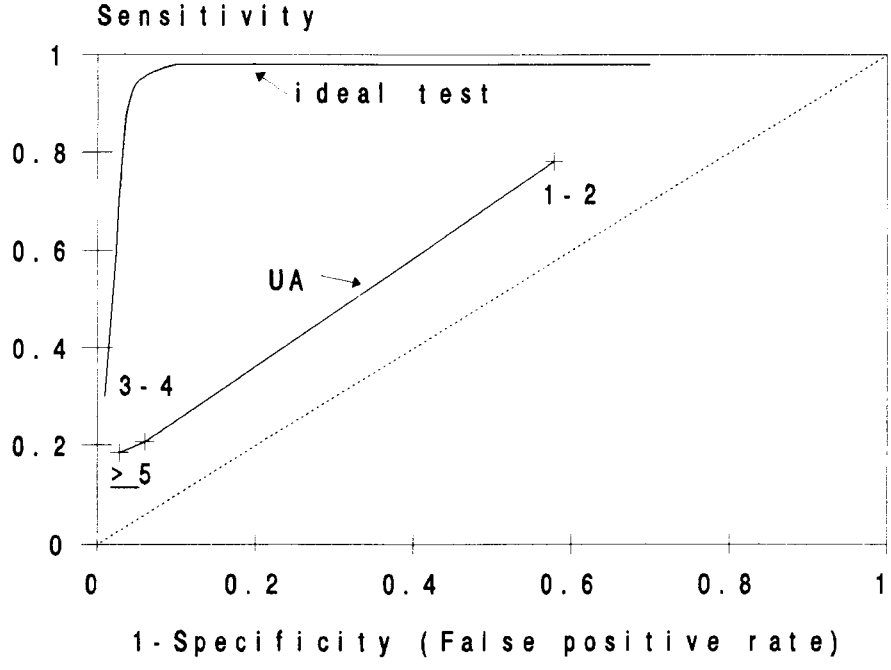

Fig. 1. Receiver operator characteristic curve of simple urinalysis (UA) for diagnosis of ABU.

RESULTS

Among the 774 subjects, there were 70 cases of urine culture which were interpreted as contaminated (a contamination rate of 9.0%) and repeated urine cultures were performed. There were 87 cases of ABU diagnosed by urine culture, giving a prevalence rate of 11.2 per cent. There were 35 subjects with a positive simple urinary test. The sensitivity and specificity of simple urinalysis in detecting ABU was 18.4 per cent and 97.2 per cent respectively. The overall accuracy was 88.4 per cent while the positive predictive value and negative predictive value were 45.7 per cent and 90.4 per cent respectively, Table 1. Table 2 shows the diagnostic performance of simple urinalysis in detecting ABU with varying diagnostic criteria for a positive test from ≥ 5 WBC/HPF to 3-4 WBC/HPF and 1-2 WBC/HPF. The diagnostic performance was not improved by changing the diagnostic criteria. The overall accuracy was best when the ≥ 5 WBC /HPF criteria was used. Fig. 1 shows the Receiver Operator Characteristic (ROC) curve of simple urinalysis using different diagnostic criteria. Specificity dropped markedly when sensitivity increased. The two most common organisms responsible for ABU in this study were Staphylococcus coagulase-negative (46.0%) and *E.coli* (24.1%) respectively.

DISCUSSION

The prevalence of ABU among pregnant women in our study was 11.2 per cent. The prevalence of ABU found from other previous studies

were 2.3 per cent to 23.9 per cent[12-17]. Simple urinalysis had a very low sensitivity (18.4%) in detecting ABU among pregnant women. Changing the criteria for a positive test did not change the diagnostic performance of the test very much. Increasing the sensitivity of the test by lowering the cut-off value to 1-2 WBC/HPF markedly decreased the specificity and the accuracy of the test. Since ABU can lead to serious consequences to both mothers[4-6] and fetuses[4,7] and the treatment for ABU is readily available and very effective in most of the cases, a more sensitive test is required. The result of this study indicates that simple urinalysis should not be used as a screening test for ABU in pregnant women. The recommendation should be to use routine urine culture for all pregnant women if feasible. One alternative would be to identify and evaluate the diagnostic performance of other screening tests such as urinary dipstick for urine nitrite and leukocyte esterase activity[18-20]. The other alternative is to identify the risk factors for ABU and perform urine culture only in this high risk group. The most common causative bacteria for ABU in this study was Staphylococcus coagulase-negative which was reported by[21] Suntharasaj et al from the southern part of Thailand. However, previous studies from western countries usually reported *E.coli* as the most common causative organism for ABU[19,22].

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การตรวจคัดกรองภาวะติดเชื้อแบคทีเรียในทางเดินปัสสาวะโดยไม่มีอาการในสตรีตั้งครรภ์ โดยการตรวจนับเม็ดเลือดขาวในตะกอนปัสสาวะ เปรียบเทียบกับการเพาะเชื้อในปัสสาวะ†

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ได้ศึกษาถึงความสามารถในการวินิจฉัยภาวะติดเชื้อแบคทีเรียในทางเดินปัสสาวะโดยไม่มีอาการในสตรีตั้งครรภ์ โดยการนับตรวจเม็ดเลือดขาวในตะกอนปัสสาวะในสตรีตั้งครรภ์จำนวน 774 ราย ที่มาฝากครรภ์ครั้งแรกโดยไม่มีอาการที่ รพ.ศรีนครินทร์ ตั้งแต่ 1 มิถุนายน พ.ศ. 2537 ถึง 31 มกราคม พ.ศ. 2538 โดยการส่งตรวจปัสสาวะวิธีธรรมดา และเพาะเชื้อในปัสสาวะทุกราย ถ้าตรวจพบเม็ดเลือดขาวในตะกอนปัสสาวะที่ปั่นแล้วมากกว่าหรือเท่ากับ 5 เซลล์ ต่อหนึ่งสนามการมองกำลังขยาย 40 เท่า ถือว่าให้ผลบวก นำผลไปเปรียบเทียบกับวิธีมาตรฐาน คือการเพาะเชื้อในปัสสาวะซึ่งถือเกณฑ์ว่ามีภาวะติดเชื้อแบคทีเรียในทางเดินปัสสาวะเมื่อตรวจพบเชื้อขึ้นมากกว่าหรือเท่ากับ 10^5 โคโลนี ต่อ ปัสสาวะ 1 มิลลิลิตร แล้วทำการคำนวณหาความไว, ความจำเพาะ ค่าในการทำนายผลบวก ค่าในการทำนายผลลบ และความถูกต้องของการใช้การตรวจนับเม็ดเลือดขาวในตะกอนปัสสาวะในการวินิจฉัยภาวะติดเชื้อแบคทีเรียในทางเดินปัสสาวะ พบว่าการตรวจดังกล่าวมีความไวร้อยละ 18.4 ความจำเพาะร้อยละ 97.2 ค่าในการทำนายผลบวกร้อยละ 45.7 ค่าในการทำนายผลลบร้อยละ 90.4 และความถูกต้อง ร้อยละ 88.4 ดังนั้นจึงไม่ควรใช้การตรวจปัสสาวะวิธีธรรมดาในการคัดกรองหาภาวะติดเชื้อแบคทีเรียในทางเดินปัสสาวะเพราะมีความไวต่ำมาก

คำสำคัญ : การตรวจคัดกรอง, ตรวจปัสสาวะ, เพาะเชื้อ, ภาวะติดเชื้อแบคทีเรียในทางเดินปัสสาวะไม่มีอาการ, สตรีตั้งครรภ์

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