Evaluation and importance of asymptomatic bacteriuria in pregnancy

S. Tugrul, *M.D.*; **O. Oral,** *Assoc. Prof.*; **P. Kumru,** *M.D.*; **D. Köse,** *M.D.*; **A. Alkan,** *M.D.*; **G. Yildirim,** *M.D.*

Zeynep Kamil Women and Children's Education and Research Hospital, Istanbul (Turkey)

Summary

Objectives: This study was undertaken to determine the incidence of asymptomatic bacteriuria (ASB) during pregnancy and its prevalance in the three trimesters.

Subjects and Methods: One hundred and ten pregnant women in their first trimester attending the antenatal outpatient clinic with no urinary tract complaints were included in the study. After perineal cleaning, urine samples were obtained from all patients for culture and microscopic evaluation. Approximately 1 ml urine was sampled using the mid-stream catch technique. Patients with bacterial counts over 100,000 with the mid-stream catch technique were considered to have asymptomatic bacteriuria. Patients fulfilling the criteria for bacteriuria were treated with either penicillin or cephalosporine for one week, depending on the in-vitro sensitivity test results.

Results: ASB rate in the study group was 8.1%. E. coli was isolated as the pathogenic organism in 77.77% of the cases with ASB. ASB was found to be more frequent in patients over age 25 and the average age of pregnant women with ASB was 29.89 ± 5.80 ($p < 0.05$). Average duration of gestation in the group with ASB was 28.11 ± 2.26 weeks. ASB rate in the group age 35 and over was 22.22% ($p < 0.05$). ASB was diagnosed in nine patients; one of these patients was in the first trimester, two were in the second trimester, and six in the third trimester. Clustering in the third trimester was found to be statistically significant ($p < 0.05$).

Conclusion: ASB distribution in the first, second, and third trimesters was 0.9%, 1.83%, and 5.6%, respectively. There was a significant relationship between advanced maternal age and incidence of ASB. Women with no bacteriuria in their initial examination in the first trimester developed bacteriuria in the later trimesters. We, therefore, suggest that it would be prudent to screen pregnant women for bacteriuria in the second and third trimesters.

Key words: Pregnancy; Asymptomatic bacteriuria.

Introduction

Asymptomatic bacteriuria is the most frequently encountered infection during pregnancy, with an overall incidence of 2-7%. Asymptomatic bacteriuria (ASB) is defined as identification of significant bacteriuria at any location in the urinary tract other than the distal uretra [1]. The concept of ASB was first coined by Kass in 1956. Kass postulated that significant bacteriuria could occur without symptoms of urinary tract infection and demonstrated the difference between infection and contamination bacterial counts. Research has demonstrated that maternal bacteriuria has the potential of increasing the risk for acute pyelonephritis, neonatal death, and premature birth and by treating bacteriuria during pregnancy the potential of decreasing this risk [2].

Pyelonephritis eventually develops in about 20-30% of pregnant women with ASB. Screening for bacteriuria in pregnant women is important to prevent morbidity due to upper urinary tract infections. Studies have revealed a 80-90% decrease in the rate of pyelonephritis after treatment of ASB [3]. Problems related to ASB other than pyelonephritis are premature birth or low birth weight, maternal anemia, and maternal hypertension [4].

E. coli is the most frequently encountered pathogen in ASB cases with isolation rates of 60-90% [5]. Other frequently isolated pathogens are *Proteus mirabilis, Klebsiella pneumoniae,* and enterococci [1].

The purpose of our study was to determine the incidence of asymptomatic bacteriuria (ASB) during pregnancy and its prevalance in the three trimesters.

Subjects and Methods

This study was conducted at the Zeynep Kamil Obstetric, Gynecology, and Pediatric Research and Training Hospital in Istanbul between January 3, 1998 and April 5, 1999. One hundred and ten pregnant women in their first trimester attending the antenatal outpatient clinic with no urinary tract complaints were included in the study. Women with complaints of dysuria, pollakiuria, hematuria, fever and flank tenderness, history of previous urinary tract disease, or who had used antibiotics during their pregnancy were excluded from the study. Urine samples were obtained from all woman attending the study with the mid-stream catch technique after appropriate cleaning of the vulva with a soap solution and normal saline. Cultures were obtained and microscopic study of the centrifuged sediment was undertaken. Urine samples were stained with the Gram and Ehrlich-Ziehl-Neelsen methods. Cultures were prepared by innoculating samples on Levinthal's blood agar and endoagar with repetitive dilution. In the microscopic evaluation of 1 ml mid-stream catch urine samples, bacterial counts over 100,000 were diagnosed as bacteriuria, counts between 10,000-100,000 were identified as suspicious cases, and bacterial counts below 10,000 were accepted as sterile. Suspicious cases that had counts

Revised manuscript accepted for publication August 19, 2005

between 10,000-100,000 bacteria per ml were recultured and control dip-stick tests were repeated. In vitro sensitivity tests for isolated bacteria were performed using the disk method. Patients were treated for seven days with penicilin or cephalosporin according to the results of the antibiotic sensitivity tests. Repeat cultures were obtained one week after the completion of the antibiotic therapy and patients with no growth on the control cultures were considered successfully treated. Pelvic dimensions were measured with ultrasonography in the coronal renal plane while the bladder was empty to evaluate pelvicalyceal dilatation. Renal ultrasonographic evaluation was performed in the right and left decubitus positions using Hitachi EUB-315 equipment and 5 Mhz sector probes. These investigations were repeated in all three trimesters. Measurements were obtained between weeks nine and 12 in the first trimester, between weeks 18 and 20 in the second trimester, and between weeks 32 and 34 in the third trimester. Statistical analyses of the parametric evaluations were performed with the Student's t-test, while the chi-square method was used for non-parametric evaluations. Statistical significance was attributed to $p < 0.05$.

Results

One hundred and ten pregnant women between ages 16 and 38 were enrolled in the study. In this group of women, nine (8.18%) were diagnosed with ASB. ASB was diagnosed in one woman in the first trimester with a prevalence rate of 0.9%, in the second trimester there were two cases with a rate of 1.83%, and six cases in the third trimester with a prevalance rate of 5.60%. The mean age of the women with ASB was 29.89 ± 5.80 (range: 18-37), while the mean age for the pregnant women without ASB was 25.12 ± 5.72 (range: 16-38). The average age of the women with ASB was significantly higher than that of the women without ASB ($p < 0.05$). The difference between the two groups with regard to gravidity and abortion rate was not statistically significant ($p > 0.05$). Average duration of gestation for the women with ASB was 28.11 ± 2.26 weeks (Table 1). As to distribution by age group, prevalance of ASB was 22.22% in the pregnant women over age 35, and this rate was significantly higher than for the other groups ($p < 0.05$) (Table 2). The number of pregnancies was between one and seven among the women enrolled in the study but did not have any relationship with ASB prevalence ($p > 0.05$) (Table 3).

Table 1. — *Patient profiles with and without ASB according to age, parity, abortion and week of gestation.*

	with ASB	without ASB	p
Age (year)	28,89 ± 5.80	25.12 ± 5.72	$p < 0.05$
Parity (n)	2.77 ± 2.37	2.62 ± 1.43	$p > 0.05$
Abortus (n)	1.76 ± 1.11	1.71 ± 1.28	$p > 0.05$
Week of gestation	28.11 ± 2.26		

ASB: asymptomatic bacteriuria.

Table 2. — *Age distribution of the cases.*

Age group	with ASB		without ASB		Total
	n	%	n	%	
< 20	1	5.88	16	94.22	17
20-24	1	3.57	27	96.43	28
25-29	2	6.45	29	93.55	31
30-34	3	12.00	22	88.00	25
≥ 35	2	22.22*	7	87.88	9
Total	9	8.18	101	91.82	110

* $p < 0.05$; ASB: asymptomatic bacteriuria.

Table 3. — *Relationship between patients with and without ASB versus number of pregnancies.*

Number of pregnancies	with ASB		without ASB		Total
	n	%	n	%	
1	2	6.66	39	93.34	41
2-4	6	8.95	54	91.05	60
5	1	7.69	8	62.31	9
Total	9	8.18	101	91.82	110

ASB: asymptomatic bacteriuria.

Women enrolled in the study were monitored throughout their pregnancy beginning with the first trimester. As to trimester distribution of the nine women with ASB, one was in the first trimester (11.11%), two were in the second trimester (22.22%), and six were in the third trimester (66.66%). The difference between the first and second trimesters was not statistically significant, however the difference between the first and third trimesters was significant ($p < 0.05$) (Table 4).

Table 4. — *Prevalence and distribution of ASB according to trimesters.*

	1st trimester	2nd trimester	3rd trimester
Number of patients with ASB	1	2	6
Prevalence of cases according to the trimester (%)	0.9	1.83	5.6*
Distribution of cases according to the trimester (%)	11.11	22.22	66.66*

*$p < 0.05$; ASB: asymptomatic bacteriuria.

Culture results of the nine women with ASB revealed *E. coli* in seven (77.77%), enterobacter in one (11.11%), and *proteus* in one (11.11%). Patients with bacterial growth in their cultures were treated for seven days with either penicilin or cephalosporin according to the results of an antibiotic sensitivity test. No growth was observed on repeat cultures taken one week after the termination of therapy and no reinfections or recurrences were observed throughout their pregnancies. Pyelonephritis was not observed in either ASB or non-ASB groups. Three cases of cystitis were diagnosed in the non-ASB group of 101 which were treated with oral antibiotics. Patients in the ASB group did not develop any other urinary tract infections.

Renal pelvic dimensions were measured in the coronal plane of all patients once each trimester. In patients with ASB, renal pelvic width was 0.7 ± 0.1 cm in the first trimester, 0.8 ± 0.2 cm in the second trimester, and 0.9 ± 0.1 cm in the third trimester. Renal pelvic widths in pregnant women with no ASB were measured as 07 ± 0.2 cm in the first trimester, 0.9 ± 0.1 cm in the second trimaster, and 0.9 ± 0.1 cm in the third trimester (Table 5). There was no statistically significant difference between the two groups ($p > 0.05$).

Table 5. — *Pelvis width (cm) in the coronal plane measured by renal ultrasonography.*

	with ASB	without ASB
1st trimester	0.7 ± 0.1	0.7 ± 0.2
2nd trimester	0.8 ± 0.2	0.9 ± 0.1
3rd trimester	0.9 ± 0.1	0.9 ± 0.1

$p < 0.05$; ASB: asymptomatic bacteriuria.

Discussion

Incidence of ASB shows great variation depending on socio-economic status, quality of medical care, age, parity, methods used in screening, and definition of bacteriuria. ASB prevalence in pregnancy has been reported to be from 2-11%, and in most studies a rate of 2-7% is given [1]. The highest prevalence is reported in poor multiparas and the lowest among primiparas with higher socio-economic status. Garaktos *et al.* reported an ABS rate of 4.7% in a study conducted in 1994 [6]. Truck reported an ASB rate of 11% in multiparas with a low socio-economic status and a rate of 2% in primiparas with a high socio-economic status [6]. In recent studies, rates as high as 25% have been reported when cultured for organisms like *Ureaplasma.* However, the pathologic significance of organisms like *Ureaplasma urealyticum* and *Garnerella vaginalis* is much debated [7]. In our study the ASB rate was 8.1%. This value corrolates well with similar studies in the literature. We feel this relatively high ASB incidence of 8.1% in our series is related to the lower socio-economic status of our patients.

When we grouped our patients according to age, pregnant women over age 35 had an ASB rate of 22.22%. Increase in age correlated well with increased ASB incidence ($p < 0.05$) (Table 2). There are contradictory reports on increased incidence with age. Kass *et al.* and Whalley *et al.* have pointed to age and parity as the cause of increased ASB prevalence, however, Ağuş and Seük reported similar rates in the 18-25 and 26-36 age groups with no significant difference between these groups [9]. Little [10] found a decrease in the incidence of ASB with increasing age in primiparas, while an increase in grand multiparas. These results do not correlate with our findings nor with the findings of Kass and Truck. Little explained that these different results were due to differences in the socio-economic status of patients [10].

Our patients were separated into four groups according to the number of pregnancies and there was no statistically significant difference among these groups ($p > 0.05$) (Table 3). Savage *et al.* showed an increase in bacteriuria with multiparity, age being more important in the non-pregnant population, and with each decade a 1% increase in the incidence of ASB in non-pregnant women [11].

In 1989 Stenqvist *et al.,* evaluated the relationship between the duration of gestation and risk of bacteriuria in 3,254 pregnant women with a finding of 0.8% at the 12th week and 1.93% at term. According to their findings the peak risk of bacteriuria was between the 9th and 17th weeks and, therefore, they have recommended starting screening for bacteriuria at the 16th week [12]. In our study, incidence peaked in the third trimester, with an average gestation of 28.11±2.26 weeks. We, therefore, feel that screening for ASB is necessary in the second, and especially in the third trimesters.

As to distribution of ASB to the time of gestation, there was one case diagnosed in the first trimester (11.11%), two cases in the second trimester (22.22%), and six cases in the third trimester (66.66%). There was no statistically significant difference between the first and second trimesters, however the difference between the first, second and third trimesters was statistically significant ($p < 0.05$) (Table 4). Gilstrap *et al.* reported an ASB rate of 67% and Cunningham *et al.* a rate of 98% in the second and third trimesters [4, 13]. In our study, 88.88% of the cases were diagnosed in the second and third trimesters. With enlargement of the uterus intraperitoneal pressure increases and with increased gestational age serum progesterone levels increase. As a result, as pregnancy progresses, the risk for urinary tract infection increases.

The pathogenic organism in most of the reported cases of urinary tract infection during pregnancy is *E. coli* with a range of 60-90%. *Klebsiella, Proteus*, an other gram-negative bacteria, ß-hemolytic streptococi and anaerobes follow. Gold *et al.,* reported an isolation rate of 70% for *E. coli,* while the rate reported by Manşon *et al.*, was 90%, and the rate reported by Low *et al.* was 60% [5]. In our study, the isolation rate for *E. coli* was 77.77%, for *Proteus* 11.11%, and for Enterobacter 11.11%.

To treat urinary tract infections, we preferred Ampisillin or cephalosporins, taking into consideration culture results, drug effects on the fetus, and gestational age. None of the cases developed pyelonephritis. Biswas *et al,* and Cruikshankve *et al.* reported acute pyelonephritis rates between 20-40% in untreated ASB in pregnant women. In treated cases of ASB the rate of pyelonephritis in pregnant women has been reported to be 2.9% [5]. With appropriate therapy and eradication of bacteriuria, the risk of pyelonephritis decreases substantially. Recurrent bacteriuria is usually the result of insufficient therapy, unknown renal disease, urinary anomalies, or presence of urinary calculus. In such cases, radiological studies are indicated after delivery. Lack of pyelonephritis in our series was probably due to the extensive information given to our patients on the seriousness of the problem and thereby increased adherence to drug therapy.

Our patients underwent renal ultrasonography once each trimester, and renal pelvic dimensions were measured in the coronal plane. We were not able to demonstrate any statistically significant difference between renal pelvic dimensions measured in the coronal plane and distribution of ASB and non-ASB patients into their trimesters ($p > 0.05$). Hertzberg *et al.* [14] compared the intrarenal resistance index in pregnant and non-pregnant women by ultrasonography. They found no change in the resistance index in physiological pelvicalyceal ectasia (grades 1-3) and it remained the same as in non-pregnant women if no co-existing pathology was present. In pregnant women, resistivity changes with pathological obstructions, pre-eclampsia and pyelonephritis were found [14]. Twickler *et al.*

compared the ultrasonograms of normal pregnant woman and pregnant women with acute pyelonephritis and discovered significantly increased pelvicalyceal ectasia in patients with pyelonephritis, which led them to the conclusion that ultrasonograpy is of value in the diagnosis of acute pyelonephritis [15].

Ultrasonography is a simple, non-invasive method used as an aid in the diagnosis of complicated upper urinary tract infections. In our study we looked into the value of ultrasonography in evaluating pregnant women with ASB. A survey of the literature did not reveal any previous studies on this subject. We were not able to show any difference in renal pelvic dimensions of pregnant women with and without ASB. We, therefore, conclude that renal ultrasonography is not indicated in monitoring pregnant women with ASB.

Conclusion

In the group of pregnant woman enrolled in the study, the total ASB rate was found to be 8.18%, and ASB distribution in the first, second, and third trimesters was 0.9%, 1.83%, and 5.6%, respectively. There was a significant relationship between advanced maternal age and ASB incidence. Women with no bacteriuria at their initial examination in the first trimester developed bacteriuria in the later trimesters. We, therefore, suggest that it would be prudent to screen pregnant women for bacteriuria in the second and third trimesters.

References

[1] Gilstrap L.C., Ramin S.M.: "Urinary tract infections during pregnancy". *Obstet. Gynecol. Clin. North Am.,* 2001, *28,* 581.
[2] Kass E.H.: "Bacteriuria and Pyelonephritis of pregnancy". *Arch. Intern. Med.,* 1960, *105,* 194.
[3] Mcnair R.D., Mcdonald S.R., Dooley S.L., Peterson L.R.: "Evaluation of the centrifuged and Gram-stained smear, urinalysis, and reagent strip testing to detect asymptomatic bacteriuria in obstetric patients". *Am. J. Obstet. Gynecol.*, 2000, *182,* 1076.
[4] Gilstrap L.C., Leveno K.J., Cunningam F.G.: "Renal infection and pregnancy outcome". *Am. J. Obstet. Gynecol.*, 1981, *141*, 709.
[5] Cunningham F.G.: "Renal and urinary tract disorders". In Cunningham F.G., McDonald P.C., Gant N.F. *et al.* (eds.). Williams Obstetrics. 17th ed. Stanford, Connecticut, Appleton & Lange, 1997, 1125.
[6] Gratacos E., Torres P.J., Vila J.: "Screening and treatment of asymptomatic bacteriuria in pregnancy prevent pyelonephritis". *The Journal of Infection Diseases,* 1994, *169,* 1390.
[7] Patterson T.F., Andreole V.T.: "Detection, significance and therapy of bacteriuria in pregnancy". *Infect. Dis. Clin. No. Am.,* 1997, *11,* 357.
[8] Andrews W., Cox C., Gilstrap L.C.: "Urinary tract infections in pregnancy". *Int. Urogynecol. J.,* 1990, *1,* 155.
[9] Agus N., Seük N.: "Asemptomatik bakteriürisi olan gebelerin idrarlarında üretilen mikroorganizmalar ve diger bulgular". A.Ü.T.F Mikrobiyoloji ve Parazitoloji Bilim Dalı Uzmanlık tezi. Ankara, 1994.
[10] Little P.J.: "The incidence of urinary infection in 5000 pregnant women". *Lancet,* 1966, *2,* 925.
[11] Savage W.E., Hajj S.N., Kass E.H.: "Demografic and prognostic characteristics of bacteriuria in pregnancy". *Medicine,* 1967, *46,* 385.
[12] Stenquist K., Dahlen-Nilsson I., Lidin-Janson G. *et al.*: "Bacteriuria in pregnancy". *Am. J. Epidemiol.*, 1989, *129*, 372.
[13] Cunningham F.G., Leveno K.J., Hankins G.D., Whalley P.J.: "Respiratory insufficiency associated with pyelonephritis during pregnancy". *Obstet. Gynecol.,* 1984, *63*, 121.
[14] Hertzberg B.S., Carroll B.A., Bowie J.D. *et al.*: "Doppler US assessment of maternal kidneys: Analysis of internal resistivity indexes in normal pregnancy and physiologic pelvicaliectasis". *Radiology*, 1993, *186,* 689.
[15] Twickler D., Little B.B., Satin A.J., Brown C.E.: "Renal pelvicalyceal dilation in antepartum pyelonephritis: Ultrasonographic findings". *Am. J. Obstet. Gynecol.,* 1991, *165,* 1115.

Address reprint requests to:
S. TUĞRUL, M.D.
Bağdat Cad. Bağdat Çıkmazı
Serap Apt. 89/3
Kızıltoprak-Kadıköy
Istanbul (Turkey)