

CLINICAL SIGNIFICANCE OF PYELECTASIS IN PREGNANT WOMEN WITH A SYMPTOMATIC BACTERIURIA

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Abstract

Background: Renal pelvi-calyceal dilatation is the result of urine retention in the upper urinary tract, it is referred also to as pyelectasis. Dilatation of pelvicalyceal system may help in differentiating between significant and non-significant bacteriuria. As Significant asymptomatic bacteriuria can progress to symptomatic urinary tract infection in pregnant ladies so can help in prevention. **Aim of the study:** To investigate the correlation between grades of pyelectasis and the significant increasing risk of occurrence of significant asymptomatic bacteriuria in pregnant women. **Study design & setting:** A case control study conducted at Al-Yarmouk Teaching Hospital, Obstetrics and Gynecological Department and extended through period from March 2020 to December 2020. **Materials & methods:** This study included ninety pregnant women with single viable fetus with gestational age ranged between (16th to 20th week +6days) according to their accurate LMP (last menstrual period) and early ultrasound scan, with ultrasound evidence of right kidney pyelectasis. without symptoms of UTI. All pregnant women had been categorized into three groups according to the degree of pyelectasis as: 1. Grade 1 correlates with renal pelvicalyceal volume up to 10 cm³. 2. Grade 2 correlates with renal pelvicalyceal volume of between 10 and 20 cm³. 3. Grade 3 correlates with renal pelvicalyceal volume of over 20 cm³. All cases had been send for midstream urine analysis and urine culture to evaluate for the presence of significant asymptomatic bacteriuria then correlate the result with the degree of pyelectasis. **Study group** 48 patients as considered with SABU while patients without SABU are considered control group. **Result:** There was a statically significant increment in the presence of significant asymptomatic bacteriuria along with increase in the degree of pyelectasis. Patients with grade 1 pyelectasis 31% of control group versus 6.3% study group had significant asymptomatic Bacteriuria ,33.3% of control versus 33.3% of significant study group had grade 2 pyelectasis and 35.7% of control versus 60.4% of significant asymptomatic bacteriuria group had grade 3 pyelectasis. Pyelectasis had positive correlation with the progress of gestation and age of mother. **Conclusion:** Pyelectasis of the right kidney during antenatal care can help in the diagnosis of significant asymptomatic bacteriuria and future symptomatic urinary tract infection.

Key word: pregnancy, pyelectasis, bacteriuria, urinary tract infection.

1. Introduction

Renal pelvi-calyceal dilatation is the result of urine retention in the upper urinary tract. It is referred also to as pyelectasis in literature. Mild pelvicalyceal dilatation during pregnancy is considered to be physiological in nature, it can observe in up to 90% of pregnant women. Pyelectasis during pregnancy rarely causes clinical symptoms and often does not require treatment. Nevertheless, urine retention in renal pelvi-calyceal system is conducive to the development of asymptomatic bacteriuria as 40% in pregnant versus non pregnant. It may also cause renal colic and may be a risk factor for recurrent urinary tract infections (UTI), pyelonephritis and renal failure⁽¹⁾, Mistaking severe pyelectasis for hydronephrosis is a common misunderstanding. Hydronephrosis is found if urinary retention has led to the thinning of the renal parenchyma and it is usually associated with the risk of renal cortex damage. In contrast, pyelectasis does not lead to parenchymal damage and kidney function deterioration⁽²⁾. According to the Polish Ultrasound Society standards (Polskie Towarzystwo Ultrasonograficzne, PTU), if pelvi-calyceal dilatation is observed, the diameter of

calyces, the pelvis and renal parenchyma thickness should be assessed to determine the grades of the dilatation. It also allows subjective evaluation of pelvicalyceal dilatation grade to be made, with the use of phrases such as “grade 1”, “grade 2” and “grade 3” pyelectasis⁽³⁾.

The comparison of pyelectasis volume calculated using 3D US/VOCAL with the EFSUMB (2,4) classification demonstrated that Grades of pyelectasis volume calculating using 3D US/VOCAL software demonstration were⁽⁴⁾: Grade 1 correlates with renal pelvicalyceal volume up to 10 cm³ which equal to grade 1 from above (EFSUMB) division. Grade 2 correlates with renal pelvicalyceal volume of between 10 and 20 cm³ equal to grade 2 from above (EFSUMB) division. Grade 3 correlates with renal pelvicalyceal volume of over 20 cm³ which equal to grade 3 from above (EFSUMB) division. The renal pelvicalyceal dilatation is rarely symptomatic in pregnant women. However, impaired urine drainage causes its retention in upper urinary tract. This helps bacterial proliferation and can lead to significant bacteriuria⁽¹⁾.

Asymptomatic bacteriuria is evaluated as significant if urine culture test reveals actively multiplying bacteria greater than 100,000 (10^5) in one ml of urine collected from mid-stream in asymptomatic patients⁽⁵⁾. Pregnant women should be screened for asymptomatic bacteriuria with a urine culture. The optimal timing and frequency of screening for urine cultures in pregnancy have not been established, but obtaining a screening urine culture at the end of the first trimester of pregnancy is recommended. Urine dipstick for leukocyte esterase will identify pyuria, but this test is not specific for asymptomatic bacteriuria. (Pyuria may result from other inflammatory disorders of the genitourinary tract.) Urinary dipstick for nitrites is also of limited usefulness because of infection with non-nitrite-producing organisms, the delay between collection and testing, and insufficient time since last voiding for nitrites to be produced at detectable levels (6,7)

Aim of the study: To investigate the correlation between grades of pyelectasis and the significant increasing risk of occurrence of significant asymptomatic bacteriuria in pregnant women.

PATIENT AND METHOD:-Study setting: This study conducted at Al Yarmouk Teaching Hospital, Obstetrics and Gynecological Department it extended through period from March 2020 to December 2020.

Study design: A case controlled study

Patients selection: This study included 90 pregnant women, with gestational age ranged between 16th to 20th +6days according to their accurate LMP (last menstrual period) and early ultrasound scan, with US evidence of Right kidney pyelectasis. All women were informed about the nature of the study and verbal consent taken from all.

Exclusion criteria: Women with symptoms and signs of UTI or history of recurrent UTI in this current pregnancy; Women with chronic renal disease, stone or abnormality or surgical intervention; Women with grade 4 pyelectasis (hydronephrosis); Women with chronic medical disease; Women were using antibiotic in preceding 2 weeks of their coming to the antenatal clinic.; Women who fit our criteria were included in this study. Detailed History, full clinical examination, measurement then women sent for baseline investigations in addition to Renal Function Test, mid-stream general urine examination.

Transabdominal abdominal US for all women done the same person using GE voluson E8 BT13 3D ultrasound (50_60) MHz for the assessment of gestational age viability exclude abnormal fetal biometry then US for assessment of renal system to exclude any obvious abnormality, for kidney assessment the pregnant woman lies in a supine position as well as on her left and right side. The examination is performed with the pregnant woman breathing steadily and while holding her maximum breath once the longitudinal section of the right kidney has been visualized and pyelectasis has been diagnosed (renal pelvicalyceal dilatation as a result of urine retention in the upper urinary tract)⁽⁴⁾, 3D US of the kidney is performed using vocal software, patients then classified in to three groups according to the degree of pyelectasis in the given gestational age as shown below⁽²⁾:

1. Grade 1 correlates with renal pelvicalyceal volume up to 10 cm³.

2. Grade 2 correlates with renal pelvicalyceal volume of between 10 and 20 cm³.

3. Grade 3 correlates with renal pelvicalyceal volume of over 20 cm³.

All ninety women were divided into 2 groups according to the result of urine C&S which sent after pyelectasis ultrasonic report as:

Group 1(study group): 48 women with asymptomatic bacteriuria (Asymptomatic bacteriuria was diagnosed if women without UTI symptoms but with 2 consecutive urine cultures have 100,000 CFU/ml of a single isolate obtained by midstream urine sample)⁽⁸⁾.

Group 2 (CONTROL group): 42 women without asymptomatic bacteriuria

Statistical analysis: -

The quantity and percentage of discrete variables are reported, and the discrete variable is analyzed using the chi square test. The two-sample t test was performed to investigate the differences in mean between two groups. When the outcome can be classified into two binary levels, binary logistic regression analysis is used to calculate the odd ratio (OR) and its 95 percent confidence intervals. To determine the association between distinct variables, linear regression analysis is used.

The area under the curve, or AUC, and its probability value (p value) are used to determine the validity of various parameters in distinguishing active cases from control (negative cases), and the area under the curve, or AUC, and its p value specify this validity (if AUC 0.9, excellent test, 0.8–0.89, good test, 0.7–0.79, fair test, otherwise unacceptable). The curve was calculated using the trapezoidal method.

The statistical analysis was performed using SPSS 22.0.0 and the MedCalc software tool, with a p value of less than 0.05 considered significant when applicable.

Results:

Ninety pregnant women were divided according to the result of urine C&S into 42 control cases versus 48 with significant asymptomatic bacteriuria, 53% of pregnant women diagnosed with unilateral pyelectasis where diagnosed as significant asymptomatic bacteriuria.

There was no significant difference in mean age, parity, miscarriage between both groups, however mean gestational age (16th to 20th +6days) was significantly higher in SABU compared to control group, as illustrated in table 3.1.

According to the degree of pyelectasis, they were divided into three groups, grade 1, 2 & 3.

13(31%) of control group had grade 1 pyelectasis by ultrasonographic examination, versus 3(6.3%) of study group. With 14(33.3%) of control versus 16(33.3%) of SABU group had grade 2 pyelectasis, and 15(35.7%) of control versus 29(60.4%) of study group had grade 3 pyelectasis. The rate of grade 3 pyelectasis was significantly higher in SABU compared to control while grade 1 was higher in control compared to SABU group as illustrated in table 3.2 and figure (1):

➤ In risk assessment, women with grade III have 8-fold increased risk of SABU compared to grade I, while grade II offered 5 folds increased risk compared to grade I, as illustrated in table 3.3.

➤ Pyelectasis (urine volume) was significantly higher in SABU compared to control women, ($20.9 \pm 6.0 \text{ cm}^3$) versus ($15.9 \pm 7.7 \text{ cm}^3$) as illustrated in figure (2). Pyelectasis showed a fair ability (since the AUC between 0.7 – 0.79) to predict SABU, as illustrated in figure (3). Assessment of the diagnostic utility of pyelectasis. AUC was 0.710, 95% CI was 0.584 to 0.784, Diagnostic utility was Fair with p-value was <0.001

The optimal cut off to predict SABU was more than 17.09 cm^3 , which offered high sensitivity compared to its specificity, in posterior probability terms the negative predictive value (NPV) showed slightly higher value its positive predictive value (PPV). Assessment of pyelectasis as predictor of SABU as Cut off was $>17.09 \text{ cm}^3$, Sensitivity was (79.2%) and Specificity was (57.1%). PPV was 67.9 and NPV was 70.6. There was direct significant correlation between pyelectasis with age and gestational age in SABU patients as illustrated in table 3.4

Table.1. Assessment of demographical and obstetrical history relationship in SABU and control group.

	Control	SABU	p-value
Number	42(47%)	48(53%)	-
Age (years)	31.4 ± 5.2	32.4 ± 5.7	0.390
Gravida	3.1 ± 1.4	3.6 ± 1.4	0.120
Parity			0.304
Nulliparous	9 (21.4%)	5 (10.4%)	
Para1	12 (28.6%)	13 (27.1%)	
Para2&more	21 (50.0%)	30 (62.5%)	
Miscarriage	20 (47.6%)	23 (47.9%)	0.978

SABU: significant asymptomatic bacteriuria, P value < 0.05 significant

Table.2: Pyelectasis grades in relation to both groups

Grade	Control without SABU	SABU (study group)	p-value
Grade I	13 (31.0%)	3 (6.30025%)	0.005
Grade II	14(33.3%)	16 (33.3%)	
Grade III	15 (35.7%)	29 (60.4%)	

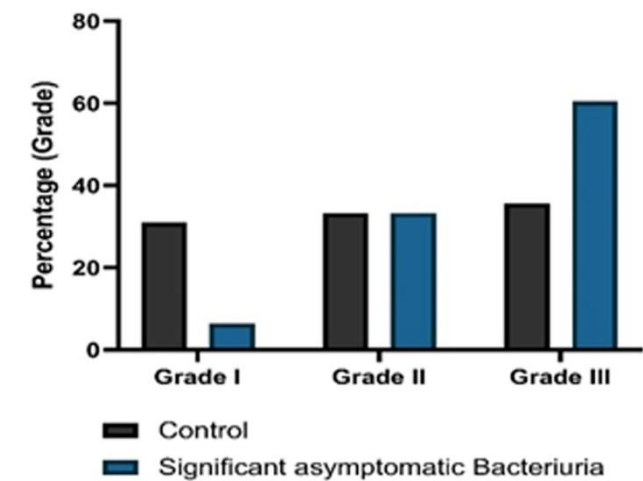


Figure (1): Grades of pyelectasis in both groups (control & SABU)

Table .3: Correlation between pyelectasis in significant asymptomatic bacteriuria

Grade	OR	95%CI	p-value
Grade I	Ref		
Grade II	4.952	1.167 – 21.025	0.030
Grade III	8.378	2.063 – 34.029	0.003

OR: odds ratio, CI: confidence interval, P value: probability value.

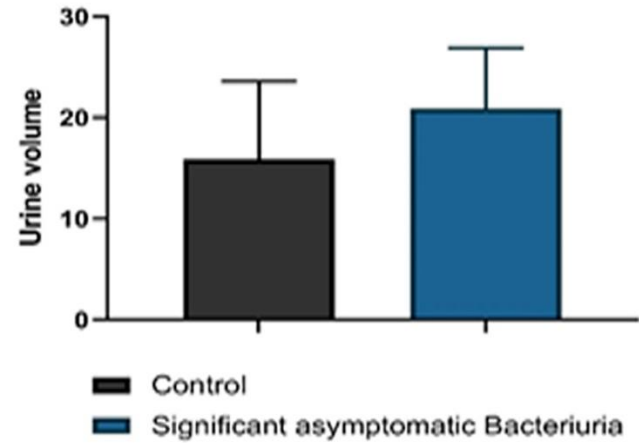


Figure (2): Assessment of urine volume (pyelectasis).
*urine volume in cm^3

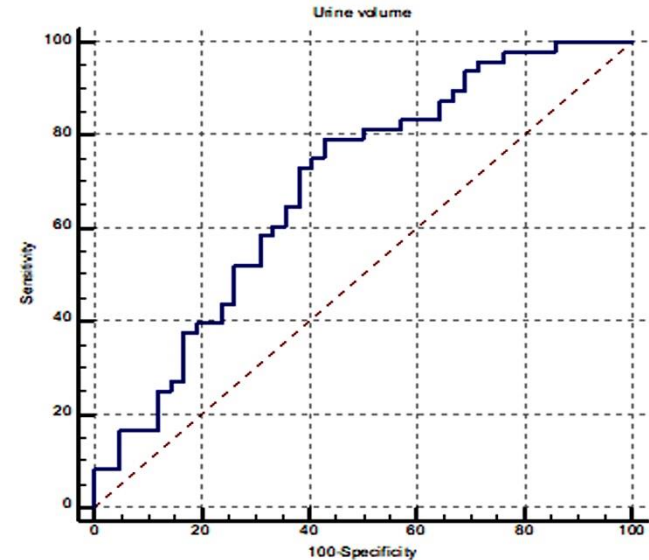


Figure (3): ROC curve that show the diagnostic utility of pyelectasis predict SABU.

Table 3.4: Relationship between pyelectasis and other variables in SABU:

Variables	Pyelectasis	
	R	p-value
Age (years)	0.422	0.003
Gestational Age(weeks)	0.854	<0.001
Gravida	0.218	0.136

r: correlation coefficient

Discussion: -

Bacteriuria is a risk factor for developing symptomatic urinary tract infection which is associated with significant maternal and fetal morbidity.

Bacteriuria was found in (53%) of pregnant women with unilateral pyelectasis in our study, while Woznaik S et al reported positive urine culture in (81.2%) and 49.7% with bacteriuria⁽⁹⁾. In this study 48 women out of 90 pregnant women were diagnosed with SABU (53%). In comparison to our study a lower prevalence were reported in 3rd Department of Gynecology of the Medical University of Lublin, the study included 48 pregnant women with diagnosed unilateral pyelectasis in the right kidney as SABU was present in (35.4%) of women⁽⁹⁾, this lower prevalence might be due to that they included pregnant women with wider range of gestational weeks ranged from 16th week to term, while in this study we included only pregnant women between 16th to 20th week of gestation were the peak incidence of SABU were reported. Different studies have put a prevalence of asymptomatic bacteriuria, in a prospective study which was conducted in the Department of Microbiology and Department of Obstetrics in Rama Medical College Hospital and Research Centre, among 300 asymptomatic pregnant women, significant bacteriuria was found in only 22 cases (7.3%), 48.9% positive cultures were for primigravida versus 51.1%, for multigravida⁽¹⁰⁾ and 8% were reported by Mangalgi S et al in 2018⁽¹¹⁾ while Sonkar N. et al reported higher incidence (16.7%)⁽¹²⁾ such variation in their result might be due to geographical differences and social habits, higher percentage in this study can be explained by that, we included only pregnant women with pyelectasis which considered as a sensitive and specific predictor for the assessment of SABU during pregnancy⁽¹³⁾.

Regarding pyelectasis volume in this study significantly higher pyelectasis volume were recorded in SABU group as ($20.9 \pm 6.0\text{cm}^3$) versus control (non SABU) ($15.9 \pm 7.7\text{cm}^3$), this result is in agreement with Woznaik S study where median pelvicalyceal volume in pregnant women with SABU was (24.48cm^3) versus control as (10.69cm^3)⁽⁹⁾.

In the current study we found the percentage of SABU increase with increase in the grade of pyelectasis from 6.30% in grade 1 to 33.3% in grade 2 and 60.4% in grade 3, the same relation was found by other others as Positive linear correlation between pelvicalyceal volume and bacteriuria ($r = 0.5207$, $p < 0.001$) was found in their study.

The rate of grade 3 pyelectasis (urine volume of 20cm^3 and more) was found more frequent in SABU than control group and the difference was statistically significant as (60.4%) versus (35.7%) which was in agreement with Woznaik S et al study, he found higher percentage (81.2%) in SABU compared to control (9.3%)⁽⁹⁾, this can be by the fact that: retention of urine secondary to impaired drainage which enhance bacterial proliferation and result in bacteriuria that can lead to symptomatic infection and serious complications in both mother and fetus⁽¹⁴⁾.

In the present study pyelectasis assessment have fair ability to predict the presence of significant SABU, since the AUC in ROC test was 0.710, on further analysis it revealed that at optimal cut off more than 17.09cm^3 has (79.2%) sensitivity which is clearly higher than its specificity (57.1%)^(15,16). A (90%) sensitivity were reported and (86%) specificity were reported by

other⁽¹⁷⁾ this indicates that the use of pyelectasis will be more suitable as a screening tool to establish a diagnosis of SABU as stated by others appears to be the strongest predictor for the cases of pyelectasis in SABU women ($r = 0.854$, $p\text{-value} < 0.001$), as urethral dilatation which starts at about 6th week and peaks at about (22th to 26th) weeks and remains so till delivery, Increased bladder volume and decreased bladder & urethral tone contribute to increased urinary stasis and ureterovesical reflux, this accounts for 70% of SABU⁽¹⁸⁾. In addition to the advanced maternal age showed moderate relationship with pyelectasis ($r = 0.422$, $p\text{-value} = 0.003$), other author found that advance maternal age more than 35 years old was a risk factor for SABU⁽¹⁹⁾.

Conclusion:-

1. Pyelectasis offered by ultrasonic assessment is a reasonable assessment of a significant asymptomatic bacteriuria in pregnant women (16th to 20th wks+6 days). A Cut off volume of $>17.09\text{cm}^3$ of pyelectasis had been used as predictor of SABU in pregnant women.
2. The percentage of SABU increases with the increase in the degree of pyelectasis, advanced maternal and gestational age⁽¹⁷⁾.

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