

Associated risk factors for urinary tract infection among pregnant women at Puskesmas Kenangan, Deli Serdang district

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Abstract. Untreated urinary tract infection (UTI) in pregnancy would cause serious complications for the mother and fetus. The purpose of this study was to assess the associated risk factors of UTI in pregnancy to prevent and control this health problem. Clean-catch midstream urine specimens were collected from 36 pregnant women using sterile containers and were being cultured using standard microbiology test. Patients' data collected by questionnaire and analyzed using SPSS version 21. The incidence of UTI is 38.9%, *Escherichia coli* (35.7%) was the commonest bacterial isolate, followed by *Staphylococcus aureus* (28.6%), *Staphylococcus epidermidis* (28.6%), and *Klebsiella pneumonia* (7.1%). Bivariate analysis of associated risk factors of UTI revealed that maternal age group 26-30 years ($p = 0.005$, PR = 4.098, 95% CI = 1.369, 12.264), gestational age in second trimester ($p = 0.009$, PR = 4.286, 95% CI = 1.120, 16.405), and sexual activity at least once in the past two weeks ($p = 0.012$, PR = 3.125, 95% CI = 1.202, 8.122) showed statistical significant association with UTI. On the contrary, there was no significant association among educational level, socioeconomic level, and parity with UTI during pregnancy.

1. Introduction

Urinary tract infection (UTI) is one of the infections that occurs along the urinary tract including the urethra, bladder, ureter, and kidney.[1] Pregnant women are more susceptible to UTI due to physiological changes in the urinary tract during pregnancy, hormonal influences, urinary tract obstruction by the uterus, and increased of vesicoureteral reflux.[2,3] The size of the growing uterus could add more pressure on the ureter, while progesterone will cause relaxation of the smooth muscle of ureter and decrease ureteral peristalsis. Therefore pregnancy itself is one of the factors which increase the risk of UTI.[4] Untreated UTI in pregnancy could lead to some serious complications that could affect both the mother and the fetus, such as anemia, preeclampsia, renal failure, septicemia, low birth weight infant (LBW), intrauterine growth retardation, premature birth, and fetal death.[1-3, 5] According to An International Urogynecological Association (IUGA)/International Continence Society (ICS), UTI is infection along the urinary tract characterized by significant bacteriuria found in urine culture and the presence of pyuria on urine microscopy.[6]



Several factors also associated with the increased prevalence of UTI among pregnant women, including maternal age (24-34 years), gestational age (peak incidence at 30-32 weeks), low education level, sexual activity during pregnancy, multiparity, and lower socioeconomic level.[1,5,7-9] The objectives of this study is to determine associated risk factors of UTI among pregnant women attending the antenatal care screening at Puskesmas Kenangan, Deli Serdang District.

2. Methods

2.1. Study site, Period, and Data Collection

This cross-sectional study was at Puskesmas Kenangan, Deli Serdang District from January 2017 to April 2017 to determine associated risk factors of UTI among pregnant women. Data for associated risk factors and information on sign and symptoms of UTI was collected using structured questionnaire.

2.2. Sample Size and Sampling Technique

A formula was used to calculate the sample size by using the following parameters [10]: data proportion of significant bacteriuria in the group of pregnant women with pyuria was from a previous study [11], $Z_{1-\alpha/2}$ (1.96), $Z_{1-\beta/2}$ (0.842), and 95% confidence interval. The final sample size was 32. All the subjects must fulfill the inclusion criteria below.

2.2.1. Inclusion criteria. Pregnant women attending the antenatal care clinic at Puskesmas Kenangan, urine microscopic examination indicates pyuria, and willing to participate by filling the informed consent.

2.2.2. Exclusion criteria. Pregnant women with a history of UTI within the past two weeks and were taken antibiotics within two weeks at the time of recruitment.

2.3. Specimen Collection and Processing

All subjects were informed of the procedure to collect clean catch mid-stream urine and minimize the risk of contamination.[3] Urine samples were in sterile glass bottles with a clear label on each bottle. A microscopic urine examination was performed on the spot to see the presence of leukocytes in urine specimens. One drop of centrifuged fresh urine on top of object glass was examined under a microscope. Specimens with leukocytes >10 / high power field (HPF) were considered pyuria.[6] All samples with pyuria were included in this study and should be followed by urine culture.

All urine specimens processed in the laboratory should be checked promptly, or stored in the refrigerator at 4°C until it was processed. Assessment of quantitative culture and bacterial identification by calibrated loop technique using standard laboratory microbiology procedure. A calibrated wire loop was for inoculation well-mixed urine samples to Blood Agar, MacConkey, and Mannitol Salt Agar (Microbiology Laboratory of Medical Faculty of Sumatera Utara University). Following the inoculation, all plates were incubated at 37°C for 24-48 hours. Bacterial growth was examined macroscopically after incubation. Culture that grew $>100,000$ colony forming unit (cfu)/mL were considered significant bacteriuria. All urine cultures with significant bacteriuria would further tested with bacterial identification by conducting a series of biochemical tests according to standard microbiological laboratory procedures.[7,12]

2.4. Operational Definitions

Urinary tract infection defined as the presence of significant bacteriuria (the bacterial colonies $>100,000$ cfu/ml in urine culture) and pyuria (the leukocytes >10 /hpf in microscopic urine examination).[6]

Maternal age refers to the unit of time to measure the length of one's life from birth to when age is calculated.

Gestational age refers to the age of fetus estimated from the first day of the last menstrual period.

Parity refers to the number of live births the subject has at the time of the study.

Monthly income refers to total family income in one month.

Education level refers to the highest education level completed by subject.

Sexual activity refers to the act of intercourse performed at least once within the past two weeks.

2.5. Ethical Consideration

The study was after conducting the ethical clearance from Commission of Health Research Ethics Faculty of Medicine, University of Sumatera Utara.

3. Results

83 subjects were willing to participate in this study and filled the informed consent. Six subjects meet the exclusion criteria (4 subjects with a history of antibiotic use and two subjects with a history of UTI) excluded from the study. Urine specimens of remaining 77 subjects were being examined microscopically, and pyuria found on 36 subjects. All the 36 subjects were the sample of this study.

The significant bacterial count was in 14 subjects (38.9%). The common bacteria found was *Escherichia coli* (35.7%), followed by *Staphylococcus aureus* (28.6%), *Staphylococcus epidermidis* (28.6%), and *Klebsiella pneumonia* (7.1%) (Table 1).

Table 1. Frequency and types of bacterial species isolated from urine culture of pregnant women at Puskesmas Kenangan, Deli Serdang District, January 2017 – April 2017.

Bacterial Isolates	Morphology	Culture results			
		Significant bacteriuria(n=14)		No significant bacteriuria(n=22)	
		n	%	n	%
<i>E. coli</i>	Gram negative, basil	5	35.7	2	9.1
<i>K. pneumonia</i>	Gram negative, basil	1	7.1	1	4.5
<i>S. aureus</i>	Gram positive, coccus	4	28.6	10	45.5
<i>S. epidermidis</i>	Gram positive, coccus	4	28.6	9	40.9

Bivariate analysis of associated risk factors of UTI revealed that maternal age group 26-30 years ($p = 0.005$, PR = 4.098, 95% CI = 1.369, 12.264), gestational age in second trimester ($p = 0.009$, PR = 4.286, 95% CI = 1.120, 16.405), and sexual activity at least once in the past two weeks ($p = 0.012$, PR = 3.125, 95% CI = 1.202, 8.122) showed statistical significant association with UTI. Another risk factors such as educational level, socioeconomic level, and parity were not significantly associated with UTI during pregnancy ($p > 0.05$) (Table 2).

4. Discussion

The prevalence of UTI during pregnancy was 38.9%. This result was higher than the incidence of UTI reported from Ethiopia [5], Tanzania [2], India [13], and Saudi Arabia.[14] The incidence was also relatively higher than other studies conducted in Indonesia.[15,16] However, this finding was lower compared to a similar study in Nigeria.[17] The result variation might be due to differences in research methods with previous studies. In previous studies, UTI was defined by the presence of significant bacteriuria (bacterial colony count $>100,000$ cfu/mL), regardless of microscopic results of urine in the subject. In this study, UTI was defined by the presence of significant bacteriuria and also pyuria.[6]

Table 2. Associated risk factors of UTI among pregnant women at Puskesmas Kenangan, Deli Serdang District, January 2017 – April 2017.

Characteristics	Culture results				Bivariate analysis		p-value
	Significant bacteriuria (n=14)		No significant bacteriuria (n=22)		PR	95% CI	
	n	%	n	%			
Age (years)							
21-25	3	21.4	16	72.7	-	-	-
26-30	10	71.4	4	18.2	4.098	1.369 - 12.264	0.005 ^a
31-35	1	7.1	2	9.1	0.846	0.162 - 4.429	0.669
Educational level							
Uncompleted primary school	0	0	1	4.5	0.615	0.107 - 3.535	0.490
Primary school	1	7.1	2	9.1	0.846	0.162 - 4.429	0.669
Junior high school	1	7.1	4	18.2	0.477	0.079 - 2.889	0.342
Senior high school	10	71.4	14	63.6	1.250	0.493 - 3.167	0.456
Higher education	2	14.3	1	4.5	-	-	-
Monthly income (Rp)							
0 - 1.000.000	7	50	14	63.6	0.600	0.262 - 1.375	0.190
≥ 1.000.000 - 2.000.000	5	35.7	7	31.8	1.327	0.590 - 2.986	0.374
≥ 2.000.000 - 3.000.000	2	14.3	1	4.5	-	-	-
Gestational age							
First trimester	2	14.3	13	59.1	-	-	-
Second trimester	8	57.1	3	13.6	4.286	1.120 - 16.405	0.009 ^a
Third trimester	4	28.6	6	27.3	0.708	0.277 - 1.810	0.349
Parity							
Nullipara	4	28.6	9	40.9	-	-	-
Primipara	7	50	10	45.5	1.118	0.493 - 2.533	0.530
Multipara	3	21.4	3	13.6	1.364	0.539 - 3.450	0.431
Sexual intercourse within past two weeks							
At least once or more	10	71.4	6	27.3	3.125	1.202 - 8.122	0.012 ^a
None	4	28.6	16	72.7	-	-	-

^aStatistically significant at $p < 0.05$.

Abbreviations: PR (prevalence ratio) ; - (reference group); 95% CI (confidence interval); Rp (rupiahs)

Four types of bacteria isolated from urine culture in subjects with significant bacteriuria, *Escherichia coli* (35.7%), *Staphylococcus aureus* (28.6%), *Staphylococcus epidermidis* (28.6%), and *Klebsiella pneumonia* (7.1%). The most frequent bacterial isolate was *E. coli*. This result was similar to findings in previous studies in Ethiopia [5], Nigeria [17], and Indonesia [18] but different with another study in Nigeria [19] and India.[13] It might be due to differences in environmental condition, socioeconomic level, educational level, and habits of maintaining personal hygiene in each region.

Our objectives were to assess the associated risk factors of UTI among pregnant women attending antenatal care clinic at Puskesmas Kenangan, Deli Serdang District. To our knowledge, this is the first study to assessed associated risk factors of UTI among pregnant women in this study area. In our study, maternal age, gestational age, and sexual activity during pregnancy was shown to be associated risk factors with UTI among pregnant women.

This study revealed the incidence of UTI was higher in the age group 26-30 years (71.4%) and maternal age was significant with increased UTI in pregnancy. Pregnant women in that age group were four times at risk of being contracted with UTI. Similar results were obtained from other studies in Ethiopia by Derese *et al.* suggested women at age groups of 25-34 years were at 3-fold risk suffered from UTI.[5] The women in this age group relatively productive and sexually active increasing the

possibility of urethral exposure exposed to bacteria during sexual activity.[5] On the contrary, another study reported an insignificant association between maternal age with UTI.[7, 8, 16, 20]

Gestational age was another risk factor to be significantly associated with of UTI among pregnant women.UTI was found more frequently in the second trimester of pregnancy (57.1%) and was four times at risk contracted by UTI compared to women in the first trimester of pregnancy. Different finding from other studies in Pakistan [8], Ethiopia [7], and Sudan [20] showed no significant association between gestational age and UTI during pregnancy.

Sexual activity was also significantly associated with UTI among pregnant women. This study showed pregnant women who recently had sexual intercourse at least once in the past two weeks were three times more likely at risk to have UTI than women who had none intercourse during that time. This finding is in line with the previous study in Pakistan by Haider *et al.* [8] who reported the higher incidence of UTI in pregnant women with a history of sexual intercourse. Another study of the similar agreement conducted in Ethiopia by Emiru *et al.* [7] reported the increased risk of UTI in women with sexual intercourse more than three times per week. Sexual activity increases the chance of contamination of urethra during the intercourse, increasing the risk of bacteria being into the urethra. [8]

This study found no significant association between level of education and UTI among pregnant women. It is in agreement with another study in Ethiopia by Emiru *et al.* [7], but not in line with other previous studies.[5,8]

Socioeconomic status was not an associated risk factors of UTI among pregnant women in this study. Different results were from several other studies reported a significant association between monthly income and UTI occurrences during pregnancy.[5,7,8]

Parity was also not significantly associated with UTI among pregnant women. This finding is similar to other studies in Sudan by Hamdan *et al.* [20] and in Ethiopia by Emiru *et al.*[7] On the other hand, a study in Nigeria by Okonko *et al.* [17] reported. multiparity increased the risk of UTI among pregnant women, a study in Indonesia by Zahroh *et al* stated nullipara were more susceptible to UTI [16], and other studies reported parity was significant with UTI in pregnancy.[8, 9]

5. Conclusion

Our study reported the presence of risk factors such as maternal age group 26-30 years, gestational age in the second trimester, and sexual activity at least once in two weeks would increase the risk of UTI among pregnant women. On the contrary, there was no significant association between level of education, socio-economic status, and parity with UTI in pregnancy. Assessment of associated risk factors should be conducted during regular antenatal care follow up.

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