The Prevalence of Asymptomatic Urinary Tract Infection and Its Relationship with Combur Strip Test Results among Pregnant Women

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Abstract: Urinary tract infection is one of the health problems among the world population including pregnant women. Several physiologic changes increase the susceptibility of pregnant women suffered from UTI. In addition, Combur strip test is one of the screening methods that can directly detect urinary tract infection especially in primary clinical care setting. Combur strip results can determine the management and prevent the serious implications among high-risk patients. This study was descriptively performed using 33 clean-catch midstream urines of pregnant women. We inoculated the specimen into blood agar and McConkey agar. Combur strip test was also performed to detect any significant pH, leukocyte esterase, nitrite production, protein, and glucose. Positive significant bacteriuria was found among 16 participants (48.4%), and Klebsiella oxytoca became the most common bacteria causing UTI (18.2%) followed by Staphylococcus aureus (15.2%), and Escherichia coli (12.1%). Significant association was also evident between parity (p-value = 0.037), leukocyte esterase (p-value = 0.022), and nitrite production (p-value = 0.009) with significant bacteriuria. Susceptibility of pregnant women suffered from UTI is evident and several indicators obtained from Combur strip still become a useful method that can be used to screen UTI among pregnant women.

1 INTRODUCTION

Urinary tract infection (UTI) is the second most common health problems after anemia among pregnant women. UTI defines as an infection of the urinary tract including kidney, ureters, bladder, and urethra. It is divided into two categories, for instance, upper UTI (kidney and ureters) and lower UTI (bladder and urethra) (Tan and Chlebicki, 2016). In primary clinical care setting, UTI becomes major clinical case admitted to the clinic. UTI is suffered by approximately 150 million people each year worldwide (Flores-Mireles, 2015), while in Indonesia alone, 180,000 of people admitted to hospital diagnosed as UTI each year, data was obtained from Department of Health in 2014. The incidence is higher among infant boys, older men, and female of all ages particularly pregnant woman (Mohsin and Siddiqui, 2010). Recurrent infection, sepsis-related UTI, chronic kidney damage in pediatric patients, pre-term birth, and high resistance to certain antibiotic caused by repeated use of antibiotic are most common serious implications related to UTI.

Escherichia coli, uropathogenic strain or UPEC, and Staphylococcus aureus are still become the most common etiologic bacteria causing UTI (80% of uncomplicated UTI). UPEC is different from intestinal pathogenic E.coli by the presence of specific virulence factors. UPEC often has attachment-pills called P-fimbriae which function as anchoring its cell to glycolipid, the outer membrane of a urinary tract epithelial cell and it is only found in the kidney (Minardi, 2011). Klebsiella pneumonia, Proteus, Acinetobacter, Staphylococcus saprophyticus, Streptococcus beta-hemolytic group B, and Pseudomonas aeruginosa also cause the UTI (Amiri, 2015).

The presence of susceptibility factor in woman population increases its incidence among them. Susceptibility factors are related with basic anatomic, behavioral, genetic, age-specific, catheterization, and pregnancy (Dielubanza and Schaeffer, 2011). In men, longer urethra causes

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delay of ascending infection progress rapidly, and it would be washed out before the infection produce symptom. While in women, short urethra could cause invasion will occur in a short period of time. Besides, it is well-documented that female urethral meatus is closer to bacterial reservoir structure such as the vagina and rectum (Michelim, 2016). As the matter of fact, pregnancy is evident as an independent risk factor of upper UTI, commonly identical with asymptomatic bacteriuria. UTI among pregnant woman will eventually occur in the sixth week of pregnancy and its peak commonly in weeks 22-24. Several changes that lead to the increased susceptibility of having upper UTI are inevitable in a pregnant woman. For instance, physiologic changes are the ones with the most influence, increased of progesterone levels would induce ureteric smooth muscle relaxation while blood volume and glomerular filtration rate are also increasing at this time. Besides, 90% of pregnant will have a renal pelvis and urethral dilatation, and it also induces vesicoureteral reflux and urinary stasis. This combination effect would become supportive for bacterial colonization (MacLean, 2001). Several studies conducted in a different location found that the prevalence of UTI among pregnant women increased, 25.3-55% in Nigeria (Ebidor, 2015; Oladeinde, 2015), 29% in Egypt (Mohamed, 2017), 18.8% in Ethiopia (Tadesse, 2014), and 56.8% in Iran (Amiri, 2015).

Morbidity and mortality related to UTI among pregnant woman are emphasized from literature consisting of serious complications in mother and fetus, maternal complication include anemia, preeclampsia, renal failure, and septicaemia while in fetus it can cause low birth weight infants (LBW), intrauterine growth retardation, premature birth, and intrauterine fetal death (Foxman, 2014), (Foxman, 2002). Therefore early detection and effective therapeutic strategies are indispensable (Matuszkiewicz-Rowińska, 2015). Bacteriuria can be diagnosed by using a semi-quantitative urine culture yet culture is costly and impractical, it takes 24 hours before experts can evaluate it. The dipstick test can replace urine culture in primary care settings and it is still reliable because it shows excellent accuracy among high-risk patients. In addition, it also can rule out uninfected patients primarily based on nitrite production and leukocyte esterase (Deville, 2004).

We conducted a study to determine the prevalence of significant bacteriuria among pregnant women of all gestational age and tried to reveal the prevalence of UTI among them. Combur strip test was also performed to identify its relationship with significant bacteriuria.

2 SIGNIFICANT BACTERIURIA

Our cross-sectional descriptive study enrolled 33 pregnant women in Medan Selayang subdistrict, Medan, Indonesia from April 2018 to May 2018. The study also did not use any inclusion criteria since we performed total sampling which means all pregnant women in the Medan Selayang subdistrict must be included in the study.

2.1 Sample Collection and Bacterial Identification

Firstly, we invited all pregnant woman with all gestational age in one place. Then we provided the full explanation about significance of UTI among pregnant women and the implications for the fetus. Without any coercion, all participant gave their approval and we collected clean-catch midstream urine samples in a sealed sterile small plastic container to proceed further examination. The whole process of the sampling was carried out in subdistrict office. We transported the specimen shortly to Microbiology Department, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia. Secondly, the bacterial assessment was begun with inoculating the specimen on the total plate agar, blood agar plate, and McConkey agar (Oxoid Basingstoke, UK) at 370 C for 24 hours. The interpretation was made in the colony forming units, equal or greater than 105 CFU/ml was mentioned as positive or significant bacteriuria, and less than 105 CFU/ml were called as negative or non-significant bacteriuria.

The results were assessed by microbiologist using total plate count method. In addition, we also performed gram staining, specific test including coagulase and catalase test, and their pattern based on biochemical reactions results if we found gram-negative bacilli in gram staining such as indole production, methyl red, Voges-Proskauer, Simmons citrate, urease, motility test, using Triple Sugar iron (TSI), gas and sulphur production, glucose, lactose, maltose, mannitol, and sucrose fermentation.

We also performed the urine test strip (Combur Test®M, Roche company) to detect pH, leukocyte esterase, nitrite, protein, and glucose shortly after the urine collection. Then, the strip was plunged into a urine sample container for 2-4 seconds at room temperature. Demographic data including age,

gestational age, and parity were also obtained by a short questionnaire method.

2.2 Ethical Consideration and Data Analysis

We conducted our study after getting permission and approval from the local ethical committee of the Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia. We provided the data by using the Statistical Package for Social Sciences 21 (SPSS Inc. version 21) in univariate fashioned. We did not assess the participant symptom nevertheless whether our findings gave us a positive result or significant bacteriuria, the participant would be referred to an OB&GYN specialist to obtain further assessment and management.

3 RESULTS AND DISCUSSIONS

This study is a part of our social activities held annually. After we gathered all pregnant woman in one auditorium and obtained a urine sample, we found that 16 of 33 pregnant women (48.4%) were positive for significant bacteriuria. The most common etiologic bacteria that caused asymptomatic UTI in our study were Klebsiella oxytoca (18.2 %), followed by Staphylococcus aureus and Escherichia coli, 15.2% and 12.1% respectively. However, we also performed a bivariate analysis to correlate specific variables with the prevalence of significant bacteriuria, by using chi-square we acquired a significant association between parity and significant bacteriuria (p-value= 0.037).

Based on Combur strip test results, we obtained a significant association between leukocyte esterase (p-value=0.022) and nitrite production (p-value=0.009) with significant bacteriuria. All related variables were also listed in Table.1. Nevertheless, there are three participants who positive for certain bacteria without significant bacteriuria, and we defined the specimen as a contaminant, the specimens were contaminated with E.coli (1 sample) and S.aureus (2 samples). After obtaining the sample, we did not perform symptom assessment. In the next few days, we were referring positive significant bacteriuria participant for an OB&GYN specialist.

Table 1: Demographic data and Combur strip test results among pregnant women.

Characteristics	Significant bacteriuria		N (%)	PR	95% CI	p-value
	Yes N (%)	No N (%)				
Age (years)						
< 30	9 (47.4)	10 (52.6)	19 (57.6)	0.833	0.208-3.345	0.797
≥ 30	6 (42.9)	8 (57.1)	14 (42.4)			
Gestational age (weeks)		6 (66.7)	9 (27.3)	2.000	0.404-9.909	0.392
< 20	3 (33.3)	12 (50.0)	24 (72.7)			
≥ 20	12 (50.0)					
Parity						
Primipara	3 (23.1)	10 (76.9)	13 (39.4)	5.000	1.040-24.034	0.037*
Multipara	12 (60.0)	8 (40.0)	20 (60.6)			
pH						
< 7	10 (58.8)	7 (41.2)	17 (51.5)	3.143	0.751-13.159	0.112
≥ 7	5 (31.3)	11 (68.8)	16 (48.5)			
Leukocyte esterase		6 (35.3)	17 (51.5)	5.500	1.219-24.813	0.022*
Positive	11 (64.7)	12 (75.0)	16 (48.5)			
Negative	4 (25.0)					
Nitrite						
Positive	11 (68.8)	5 (31.3)	16 (48.4)	0.140	0.030-0.653	0.009*
Negative	4 (23.5)	13 (76.5)	17 (51.5)			
Protein						
Positive	1 (100.0)	0 (0.0)	1 (3.5)	-	-	-
Negative	14 (43.8)	18 (56.3)	32 (96.5)			
Glucose						
Normal	14 (43.8)	18 (56.3)	32 (96.5)	-	-	-
Elevated	1 (100.0)	0 (0.0)	1 (3.5)			

Urinary tract infection is defined as the presence of symptoms and significant bacteriuria while asymptomatic bacteriuria or asymptomatic pyuria is characterized by significant isolation amount of bacteria obtained from asymptomatic patients (Yamamoto, 2016). Symptomatic UTI patients are required to be treated while asymptomatic patients need further assessment or positive result from double tests using dipstick is indicated to be managed (Goonewardene and Persad, 2015). Nevertheless, we did not perform any symptoms assessment; therefore, use of the term UTI and significant bacteriuria are interchangeably used in our study.

Urinary tract infection or the presence of significant bacteriuria in a pregnant woman is higher than in other populations. We previously described physiologic changes that increased the susceptibility of pregnant women suffered from UTI is evident. There are 48.4 % of pregnant women are categorized with significant bacteriuria, in our former study the incidence of UTI is 38.9% (Laily, 2018), and individual risk factors also had significant association including age, gestational age, and sexual intercourse. A study conducted by (Shaheen, 2016) detect UTI among 32% of pregnant women and highly associated with the socioeconomic issue, unsatisfied personal hygiene, history of diabetes mellitus, anemia, and history of previous UTI. UTI perception, screening methods, confounding factors such as age, parity, and pregnancy have led to variability in UTI prevalence at different sites. The study also stated that UTI is commonly associated with urban living than rural (56.4% in urban versus 43.6 % in rural).

Based on demographic data, we only acquired a significant relationship between parity and significant bacteriuria (p=0.037). In contrast, (Obirikorang, 2012) found there is no significant relationship between parity and significant bacteriuria but pregnant woman with multiparity had higher prevalence of asymptomatic UTI (p=0.251), it might be explained by the low incidence of asymptomatic UTI, only about 9.5%, and there was no clinical data on UTI signs and symptoms provided in the study. We also included data on gestational age, and we found that gestational age ≥ 20 weeks had a higher prevalence of significant bacteriuria than under 20 weeks, but it is not statistically significant. (Alghalibi, 2007) also proved a similar result while (Sullivan, 2016) and (Kline, 2014) using a murine model to correlate age and parity with UTI, it was evident that age and parity affected the severity of UTI. Hormonal changes cause susceptibility, mainly estradiol, occurred during gestation and childbirth.

We also performed a urine dipstick to detect pH, leukocyte esterase, nitrite production, protein, and glucose. We only found nitrite and leukocyte esterase were significantly related with significant bacteriuria, p= 0.009 and p=0.022 respectively. In one study, the dipstick method or Combur strip test still becomes one of the highly sensitive tests that can be easily used to screen, the accuracy was about 72% (Laosu-angkoon, 2011). A study performed in Kenya 77.5 % of pregnant women expressed as positive UTI using dipstick while 67.5% were positive on urine microscopy (Fred, 2015). Therefore, the use of a dipstick method can still be considered. Nitrite and leukocyte esterase are commonly used as a reference marker for UTI. Nitrite formation will occur if the infection progress, it is the product of bacterial reduction product of urine nitrate and highly associated with gram-negative bacteria (Majid and Buba, 2010). Our study result found a significant relationship between nitrite and significant bacteriuria since in our study we detected almost 60% of identified bacteria is gram-negative including K.oxytoca and E.coli.

4 CONCLUSIONS

The high prevalence of UTI among pregnant woman is obvious from our study. In addition, Combur strip test still becomes a reliable method for screening UTI, and it will reduce the time between admission-prompt treatment. This study has become part of our social activities held in several locations. Therefore, we only provided some demographic data and related them with significant bacteriuria. Further assessment related with UTI symptomatology was held in related specialist since early detection and prompt management are compulsory. Lastly, we also conducted health education session about UTI among pregnant woman, and it has been the first step in raising awareness of its several serious complications.

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