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Exploring the Link Between Severe Preeclampsia and Asymptomatic Urinary Tract Infections in the Third Trimester: A Cross-Sectional Study

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Abstract:

Urinary tract infection (UTI) is prevalent in women between 16 and 35 years old. UTI occurs in 2%-7% of pregnant women and affects the inflammatory process, which damages the vascular endothelium by decreasing nitric oxide (NO). This condition is evident in pregnant women with preeclampsia. This research aims to determine the relationship between urinary tract infections and preeclampsia in the third trimester of pregnancy in the delivery room at Ulin Regional Hospital Banjarmasin from January to December 2023. This study's design was cross-sectional observational using secondary data, including patient registers and medical record data. The sample included those who came in with labor, not labor and post-partum conditions for any causes and third-trimester pregnant patients diagnosed with UTI and Severe Preeclampsia in the delivery room of Ulin Regional Hospital, Banjarmasin and use chi-square test for each category. The 119 total pregnant patients with UTI in the third trimester arriving in the delivery room, 73 of them were diagnosed with preeclampsia. Most of them were under 35 yo. A total of 48 patients had multigravida status in all cases of UTI in preeclampsia in the third trimester of pregnancy. The chi-square analysis of the relationship and preeclampsia in pregnant women in the third trimester with p-value of 0.000, and the Odds ratio value was 4.4. Third-trimester pregnant women who suffer from urinary tract infections are 4.4 times more likely to experience preeclampsia.

Keywords: Severe Preeclampsia; Urinary Tract Infection; Third Trimester

Introduction

Urinary tract infection (UTI) is a disease that still occurs frequently in society, especially in women, due to the proliferation of microorganisms resulting in inflammation of the uroepithelial cells due to the proliferation of bacteria, viruses, or fungi, which can give different symptoms to each patient.[1] UTI is also one of the infections that requires the most medical treatment and causes high morbidity and medical expenses in all age groups. Urinalysis examination in UTI sufferers is a commonly performed examination.[2] Urinalysis can confirm the correct diagnosis of UTI so that it can help in providing appropriate therapy.[3,4] The number of UTI sufferers in Indonesia in 2014, according to the Ministry of Health of the Republic of Indonesia, was 90 to 100 cases per 100,000 population per year, or 180 thousand cases per year.[5]

Urinary tract infections are prevalent in women between the ages of 16 and 35, with 10% of women getting an infection every year and more than 40% to 60% experiencing an infection at least once in their lives. The incidence of bacteriuria in pregnant women is approximately the same as in non-pregnant women, but recurrent bacteriuria occurs more frequently during pregnancy.[4] UTIs occur in 2 to 7 percent of pregnant women, usually occurring during early pregnancy in only about a quarter of cases identified in the second and third trimesters. Without treatment as many as 20 to 35 percent of pregnant women with asymptomatic bacteriuria will experience symptomatic urinary tract infections, including pyelonephritis, during pregnancy.[4,5]

Most pregnant women experience UTI caused by increased urinary volume, urethral dilatation, decreased urethral tone, and glycosuria, which facilitates bacterial growth in the urinary tract. Urinary tract infections affect the inflammatory process, which damages the vascular endothelium by decreasing nitric oxide (NO), which functions as a vasodilator and is needed to maintain the vascular vasodilation tone. Impaired vascular endothelium function caused by inflammatory processes is evident in pregnant women with preeclampsia. Impaired uteroplacental perfusion as a result of an inadequate placenta is a critical inflammatory stimulus in women with preeclampsia.[6,7]

This research aims to determine the relationship between urinary tract infections and pre-eclampsia in the third trimester of pregnancy in the delivery room at Ulin Regional Hospital Banjarmasin from January to December 2023.

Research Method

Materials And Methods

This study design was cross-sectional observational with secondary data, including patient registers and medical record data. It was conducted in the delivery room of Ulin Regional Hospital Banjarmasin from January to December 2023.

The population in this study were pregnant women in their third trimester who had been diagnosed with UTI and PEB in the delivery room at Ulin Regional Hospital, Banjarmasin, from January to December 2023. The sample was taken using a total sampling technique based on inclusion and exclusion criteria. The inclusion criteria were a pregnant patient in the third trimester was diagnosed with UTI and severe preeclampsia in the delivery room of Ulin Regional Hospital, Banjarmasin, pregnant patients who came in laboring, non-laboring, and post-partum conditions for any cause, pregnant patients in the third trimester who have been diagnosed with preeclampsia, pregnant patients in the third trimester who have been diagnosed with a urinary tract infection, the patient has had a complete laboratory examination (urinalysis).

Results

In this study, the total number of pregnant patients with UTI in the third trimester arriving in the delivery room of Ulin Regional Hospital from January to December 2023 was 119. The highest number of UTI patients accompanied by preeclampsia was 73 patients. The highest number of people

affected was under 35 years of age and 45 people (61.6%) of the total UTI patients with preeclampsia in the third trimester of pregnancy. This is because the young age between 18-39 years has high sexual activity.

Table 1 Distribution of demographic characteristics of UTI patients with comorbid diagnoses

Demographics		Amount (%)					
		Preeclampsia	PROM	PPI	Anemia	Gestational DM	No Complications
Comorbid Diseases	Total	73 (61.3%)	18 (15.1)	3 (2.5%	1 (0.9%)	12 (10.1%)	12 (10.1%)
Age	< 35 yo	45 (61.6%)	13 (72.2)	3 (100%)	1 (100%)	6 (50%)	11 (91.6%)
	≥ 35 yo	28 (38.4%)	5 (27.8)	0 (0%)	0 (0%)	6 (50%)	1 (8.4%)
parity	Nulli parous	25 (34.2%)	7 (38.8%)	1 (33.3%)	1 (100%)	4 (33.3%)	2 (16.6%)
	Multi gravida	48 (65.8%)	11 (61.2%)	2 (66.7%)	0 (0%)	8 (66.7%)	10 (83.4%)
Body Mass Index (BMI)	Non Obese	26 (35.6%)	10 (55.5%)	2 (66.7%)	1 (100%)	2 (16.6%)	8 (66.7%)
	Obesity	47 (64.4%)	8 (45.5)	1 (33.3%)	0 (0%)	10 (83.4%)	4 (33.3%)
Socio economics	Middle to upper	13 (17.8%)	5 (27.8%)	2 (66.7%)	0 (0%)	2 (16.6%)	2 (16.6%)
	Middle down	60 (82.2%)	13 (72.2%)	1 (33.3%)	1 (100%)	10 (83.4%)	10 (83.4%)
	PKM	26 (35.6%)	5 (27.7%)	2 (66.7%)	0 (0%)	2 (16.6%)	4 (33.3%)
Referral Case	Outpatient Clinic	9 (12.3%)	3 (22.3%)	0 (0%)	1 (100%)	1 (8.4%)	2 (16.6%)
	Other Hospitals	34 (46.5%)	5 (27.7%)	0 (0%)	0 (0%)	1 (8.4%)	2 (16.6%)
	Come By herself	4 (5.6%)	3 (22.3%)	1 (33.3%)	0 (0%)	8 (66.7%)	6 (33.5%)
Ethnic groups	Banjar	48 (65.8%)	12 (66.6%)	3 (100%)	1 (100%)	10 (83.4%)	8 (66.7%)
	Java	25 (34.2%)	6 (33.4%)	0 (0%)	0 (0%)	2 (16.6%)	4 (33.3%)
Domicile	Banjarmasin	52 (71.2%)	12 (66.6%)	3 (100%)	1 (100%)	8 (66.7%)	10 (83.4%)
	Outside	21 (28.8%)	6 (33.4%)	0 (0%)	0 (0%)	4 (33.3%)	2 (16.6%)

Table 2. Distribution of characteristics of UTI patients during pregnancy

UTIs	Frequency (n)	Percentage (%)
With Symptoms (Symptomatic)	18	24.6 %
No Symptoms (Asymptomatic)	55	75.6 %

Table 3. Urinalysis Results

Urinalysis results	Results	Number (N/%) 73 (100%)
Macroscopic		
	1+	27 (36.9%)
	2+	13 (17.8%)
	3+	12 (16.5%)
	Negative	21(28.8%)
Biochemistry		
Nitrite	Negative	67 (91.7%)
	Positive	6 (8.3%)
Bacteriuria	1+	43 (58.9%)
	2+	8 (10.9%)
	3+	4 (5.5%)
	Negative	18 (25.2%)
Leukocyturia	0-3	42 (57.5%)
	4-10	13 (17.3%)
	>10	18 (25.2%)
Erythrocyturia	0-2	44 (60.2%)
	3-5	11(14.6%)
	>5	18 (25.2%)

Tabel 2 showed that the number of asymptomatic UTI as many as 55 patients (75.6%). Research conducted by Salim Surjawidjadja noted that the incidence of asymptomatic UTI was 65% of the 184 patients.[13] Asymptomatic UTI are more common than symptomatic UTI. Lack of information sources in pregnant women's lack of knowledge about UTI.[14,15]

In tabel 3 on microscopic examination, the highest number of bacteriuria was +1. Leukocyturia results were the highest, followed results 0-3 and results >10. The results of this study are based on the theory that most UTI are accompanied by leukocyturia, which occurs as a form of the body's immunological response to infection and inflammation. The highest erythrocyturia result was 0-2 followed >5 and 3-5. If only 0-2 erythrocytes/field of view are found, they can be categorized as normal. It is considered abnormal if there are >2 cells/field of view. The presence of erythrocytes in the urine can be found in glomerular damage, kidney trauma, stones in the urinary tract, urinary tract infections, and physical trauma.[2,4,16,17]

Discussion

Result In the chi-square test, there is a relationship between UTI and preeclampsia in pregnant women in the third trimester, which obtained p-value of 0.000. A significant value was obtained because the value was $p<0.05$. During pregnancy, hormonal changes occur progesterone and estrogen hormones are increased which causes narrowing of the ureters and bladder. An increase in plasma volume during pregnancy leads to a decrease in urine concentration and bladder volume. The combination of all these factors causes urinary stasis and uretero-vesical reflux. [8,9,10]

Structural and hormonal changes during pregnancy predispose women to the development of UTI.Pregnant women experience ureteral dilatation. Decreased ureteral tone is accompanied by reduced bladder tone, which contributes to urinary stasis and ureterovesical reflux. Urinary stasis may also result from the enlargement of the uterus mechanical compression of the ureters and bladder. The larger the pregnancy, the more susceptible you are to UTI because it

allows obstruction to occur due to its size. The uterus causes dilatation of the pelvicalyceal system and ureters. The peak incidence of UTI is at 28-40 weeks of gestation due to high levels of the hormone progesterone and obstruction by the uterus.[8,11,12]

Urinary tract infections in pregnancy cause an increase in systemic inflammatory mediators. This inflammatory mediator will influence various pregnancy conditions, one of which is preeclampsia. Preeclampsia is associated with the role of inflammatory mediators such as IL-6, IL-8, and INF-γ rather than regulatory cytokines such as IL-6, IL-8, and INF-γ. such as IL-4, IL-5, and IL-10. Placental interleukin levels, especially IL-6 and TNF-α, will increase excessive macrophage activation and NK cell failure, causing impaired vasodilation in the spiral arteries.[11,13,14]

Preeclampsia is specified maternal endothelial dysfunction in multiple organ. in two steps are first, placental ischemia happens because of abnormal placentation. In the next step, ischemic placenta releases soluble necrotic and apoptotic factors into the maternal circulation which causes systemic endothelial dysfunction. Renal is one of the multiple organ with specific endothelialis glomelurus and microangiopathy thrombotic. The Abnormally vascularies development of placenta such as ischemia and hypoperfusion are associated with the pathogenesis. In Hypoxic placenta, upregulated HIF-1 induced increase sFlt-1 and sEng and other mediators inflamation maternal circulation.[12,13,14,15]

sEng as an angiogenic protein that extracellular domain of endoglin found on the ECs and placental syncytiotrophoblasts. it binds to TGF-β as a prohibits and coreceptor signal of TGF-β in trophoblasts make to poor placentation. sFlt-1 is inhibits VEGF receptors on ECs and podocytes and destroys the fuction of glomerular filtration barrier (GFB). GFB consists of three layers such as endholetlial layer, glomelurus basal membrane and podocyte and slit diaphragma. Endothelialis glomelurus is swelling and noticeable capillary glomerulus.[14,16]

In glomelurus VEGF has been producted by podocytes and in Endotelial cell was regulated. Flow of VEGF from podocytesto Endotelial cell s and its binding to VEGFR2 on ECs induces their maturity, regulates appearance of fenestra and also their migration into the glomerular tuft. It is also suggested that this effect on mesangial cells is, in part, due to the disruption of PDGF-B production by ECs as source of PDGF-B. PDGF-B is an essential factor for cell migration.[9,15,17]

Damaged EC dysfunction is the main feature of glomerular involvement with microscopic findings indicate sweeling endothelial cells and subsequent occlusion lumens of capillary. The severe preeclapsia correlated with glomerulus capillary, swelling of endothelia and subsequent occlusion. Fibrinolysis and thrombopoiesis both are triggered by coagulopative and hematologic complex abnormality in severe preeklampsia that induce clotting and vessel occlusion in endothelial cell and tissue factors is converts balance anticoagulopati to more coagulopation. Platelets activations are larger in size and express increased levels of fibrinogen receptors, von Willebrand factor, thromboxane and selectin are associated abnormalities coagulation. Aggregation of Platelet is triggered to elevation TMA2 and decreased NO and prostaglandin levels secondary to ECs damage.[2,17,18,19,20]

Podocytes cell is cells differerentied in outter sufface of glomelurar membrane basement and make charge selective barriers called slit diaphragma that regulation permeabilitas of bariiers glomelurus by a sieva to limit entrance protein to urin. Damage of endothelial cells can make demage of podocytes produce endotelin-1. Podocytes injury can make proteinuria. Demage slit diaphragmas can make decresde of nephrin that signaling pathways also regulate cell polarity and cytoskeletal stabilization.[21,22,23]

Conclusions

The main conclusion of the study may be that the highest number of patients with UTI and preeclampsia in the third trimester were under 35 years of age, which is the reproductive age range. Most patients have multigravida parity with an obese BMI. The demographic characteristics of patients diagnosed with UTI are referral patients from other hospitals, Banjarnese, and domicile in Banjarmasin.

Urinalysis results in leukorrhea patients showed normal specific gravity. In the biochemical examination, the most negative nitrite results were 91.7%. On microscopic examination, leukocyturia has 0 to 3 leukocytes, and erythrocytes have 0 to 2 cells. Bacteriuria 1+ is the highest amount of bacteria found in this study.

The results of this study also explain the relationship between UTI and preeclampsia in pregnant women in the third trimester. The Chi-square test results of this relationship showed that the p-value was 0.000,and the Odds ratio value was 4.4.

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