Relationship of Age, Body Mass Index, Gravida, and Parity in Pregnant Women with the Incidence of Preeclampsia

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Abstract
Objective: According to the 2016 Routine Health Profile Report, the exact causes of maternal mortality are hypertension (33.07%) and bleeding (27%). The exact cause of preeclampsia is unknown and is therefore referred to as the "disease of theory". This study aimed to determine the relationship between age, BMI, gravida and parity with preeclampsia.
Methods: This cross-sectional, analytic observational study, conducted in Hasan Sadikin Hospital, Bandung. Subjects are pregnant women undergoing antenatal care at Hasan Sadikin Hospital Bandung, in May 2020 a total of 40 women with a gestational age of ≥ 20 weeks. The univariate and bivariate data were analyzed with SPSS. The Saphiro Wilk test was used to measure the data normality. The ANOVA one-way test and Fisher test were used to analyze the bivariate data.
Results: Results show that of 19 samples with preeclampsia, 13 people (68.4%) were older than 35 years old with p-value of 0.042 which indicates a significant relationship. There is no significant difference between BMI, gravida, and parity, with the incidence of preeclampsia with p-value 0.602, 0.664, and 0.661 respectively.
Conclusion: There is a relationship between mother's age and the incidence of preeclampsia in Dr. Hasan Sadikin Hospital with p value = 0.042. This means older than 35 years old mothers have a tendency to develop preeclampsia.

Key words: *Preeclampsia, age, BMI, gravida, parity*

Hubungan Usia, Indeks Massa Tubuh, Gravida, dan Paritas pada Ibu Hamil dengan Insidensi Preeklamsia

Abstrak
Tujuan: Penelitian ini bertujuan untuk mengetahui hubungan paritas dengan preeklamsia.
Metode: Studi observasional analitik potong lintang ini dilakukan di Rumah Sakit Hasan Sadikin Bandung. Subjek adalah ibu hamil yang menjalani pemeriksaan kehamilan di RS Hasan Sadikin Bandung, pada bulan Mei 2020 sejumlah 40 orang dengan usia kehamilan ≥ 20 minggu. Data univariat dan bivariat dianalisis dengan SPSS. Uji Saphiro Wilk digunakan untuk mengukur normalitas data. Uji satu arah ANOVA dan uji Fisher digunakan untuk menganalisis data bivariat.
Hasil: Hasil penelitian menunjukkan bahwa dari 19 sampel dengan preeklampsia, 13 orang (68,4%) berusia lebih dari 35 tahun dengan p-value 0,042 yang menunjukkan hubungan yang signifikan.
Kesimpulan: Ada hubungan usia ibu dengan kejadian preeklampsia di RSUD Dr. Hasan Sadikin dengan nilai p = 0,042. Ini berarti ibu yang berusia lebih dari 35 tahun memiliki kecenderungan untuk mengalami preeklamsia.

Kata kunci: *Preeklamsia, usia, IMT, gravida, paritas*

Introduction

The World Health Organization (WHO) stated that maternal mortality is a measure of the well-being of a country's society. According to WHO data, in 2017 maternal mortality rate (MMR) was 462 per 100,000 births, with an estimated maternal mortality rate of 295,000.[1] Africa and Asia account for approximately 86% (295,000) of global maternal mortality estimates. The decrease in MMR in Indonesia occurred from 309 to 228 between 1991 and 2017.[2]

According to the 2016 Routine Health Profile Report by National Institute of Health Research and Development (*Badan Penelitian dan Pengembangan Kesehatan* or Litbangkes), the exact causes of maternal mortality are hypertension (33.07%) and bleeding (27%). This indicates that hypertension remains the most crucial risk factor for the death of pregnant women with high blood pressure. In Indonesia, pre-eclampsia causes a high maternal mortality rate of 24%.[3]

Preeclampsia is a disorder of pregnancy characterized by the onset of high blood pressure after 20 weeks' gestation, often accompanied with proteinuria. Hemolysis, thrombocytopenia, and impaired liver and kidney function signify severe cases. Preeclampsia is accepted as the cause of poor perinatal outcomes and if untreated, it may result in eclampsia.[4]

To date, the exact cause of preeclampsia is unknown and is therefore referred to as the "disease of theory." Some theories about the causes of preeclampsia are 1. Maternal-placenta-fetal immunological maladaptation, 2. Inflammation, 3. Abnormal trophoblast infiltration, 4. Genetics.[5] The etiology-based classification is divided into two major groups based on the onset of clinical symptoms—early onset preeclampsia and late onset preeclampsia. Late-onset preeclampsia reflects the etiology of maternal non-placental factors. The incidence is about 80% of cases of preeclampsia. This image is usually average fetal growth, no intrauterine growth restriction (IUGR), images of spiral arteries within normal range, normal cord blood flow, maternal risk (obesity, anemia, diabetes mellitus, gemelli, maternal age, parity infection, gestational age).[6]

According to previous studies, there is a relationship between age, body mass index (BMI), parity in the occurrence of hypertension in pregnancy, as for the risk factors that can be grouped into several risk factors as follows: primigravida, primipaternity, hyperplacentosis, extreme age, family history ever preeclampsia/ eclampsia, kidney disease and pre-existing hypertension and obesity.[7]

Preeclampsia often occurs during the pregnancy of the first child, and rarely occurs in subsequent pregnancies, except in people with obesity, diabetes, hypertension or multiple pregnancies.[8] This study aimed to determine the relationship between age, BMI, gravida and parity with the incidence of preeclampsia to help clinicians determine the outcome of one's pregnancy with preeclampsia risk factors.

Methods

This research was a cross-sectional, analytic observational study, which was conducted in Hasan Sadikin Hospital, Bandung. Sampling was calculated and the results were 40 people. Subjects are all pregnant women undergoing antenatal care at Hasan Sadikin Hospital, Bandung, in May 2020 with a gestational age of ≥ 20 weeks. Other inclusion criteria were risk of developing preeclampsia (history of preeclampsia, family factors, history of preeclampsia, hypertension, diabetes mellitus, Gemelli, age more than 35 years and less than 20 years, obesity, autoimmune, antiphospholipid syndrome, and kidney disease). While the exclusion criteria in this

study are patients who do not have a complete medical record.

Patient selection was made by looking for patients with general criteria, clinical criteria, mean arterial pressure, and ultrasound of the uterine arteries which risk preeclampsia. After all the inclusion-exclusion criteria were met, informed consent was obtained.

The ethical clearance was approved by the Committee on Ethics in Medical Research at RSUP Dr Hasan Sadikin Hospital (Approval number: LB.02.01/X.6.5/207/2020) on 06/08/2020).

The medical history data obtained from history taking. The weight and height of the subjects were measured three times with Tanita scales and a microtome to calculate body mass index (BMI). The BMI was then classified according to WHO, which stipulated underweight, normal, overweight, and obese. Blood pressure was measured with an aneroid sphygmomanometer three times in a sitting position on the dominant hand.

The research data were analyzed with Statistical Package for the Social Sciences (SPSS) version 25 for Windows, where the data were divided into univariate and bivariate data. Univariate data showed the respondents distribution based on characteristics. In contrast, bivariate data showed the respondents distribution based on the relationship between age, BMI, *gravida* status, parity status and incidence of preeclampsia. Saphiro-Wilk test was used to measure the data normality. The independent T-test, Mann-Whitney and chi-square test were used to analyze the bivariate data. The data were presented in tables.

Results

This research was a cross-sectional, analytic observational study, which was conducted in Hasan Sadikin Hospital, Bandung. Sampling was calculated and the results were 40 people.

Subjects are all pregnant women undergoing antenatal care at Hasan Sadikin Hospital, Bandung, with a gestational age of ≥ 20 weeks. Other criteria were risk of developing preeclampsia (history of preeclampsia, family factors, history of preeclampsia, hypertension, diabetes mellitus, Gemelli, age more than 35 years and less than 20 years, obesity, autoimmune, antiphospholipid syndrome, and kidney disease). Patient selection was made by looking for patients with general criteria, clinical criteria, and blood pressure which risk preeclampsia.

Table 1 presents samples' characteristics based on maternal age, BMI, parity and gravida status, medical history, and also clinical characteristics. From table 1, we can see that the mean of age in the preeclampsia group and normal pregnancy group are different. The Preeclampsia group (mean $\pm$ SD 33.1 ± 5) was older than the normal pregnancy group (mean $\pm$ SD 29.8 ± 4.7). We can also conclude that most of the samples have multiple pregnancies, had one viable child before the study, and had a normal BMI.

We performed a normality test using the Shapiro-Wilk test and the result showed a normal distribution in age and parity status, meanwhile the rest of the variables (BMI, gravida status) were not in a normal distribution. Therefore, we used an independent T-test to determine the relationship between mother's age and the incidence of preeclampsia, Mann-Whitney test to determine the relationship between mother's BMI and the incidence of preeclampsia, chi-square to determine the relationship between parity status and the incidence of preeclampsia and fisher to determine the relationship between gravida status and the incidence of preeclampsia.

Table 2 shows the relationship between mother's age and preeclampsia has a significant relationship. This means older than 35 years old mothers have a tendency to develop preeclampsia.

Table 1 Characteristics of subjects

Variable	Frequency			
	Preeclampsia		**Normal Pregnancy**	
	n	**%**	**n**	**%**
Obstetric Characteristics				
Age > 35 years old				
Yes	6	31.6%	3	14.3%
No	13	68.4%	18	85.7%
Mean±SD	33.1±5		29.8±4.7	
Gravida				
Primigravida	2	10.5%	3	14.3%
Multigravida	17	89.5%	18	85.7%
Parity				
Nullipara	2	10.6%	3	14.3%
Primipara	10	52.6%	13	61.9%
Multipara	7	36.8%	5	23.8%
Body Mass Index				
Normal	15	78.9%	16	76.2%
Obese	4	21.1%	5	23.8%
Medical History				
Preeclampsia history				
Yes	10	52.6%	9	42.8%
No	9	47.4%	12	57.2%
Hypertension history				
Yes	10	52.6%	14	66.7%
No	9	47.4%	7	33.3%
Autoimmune disease				
Yes	0	0.0%	1	4.8%
No	19	100%	20	95.2%
Cardiovascular disease				
Yes	1	5.3%	0	0.0%
No	18	94.7%	21	100%
Kidney disease				
Yes	1	5.3%	1	4.8%
No	18	94.7%	20	95.2%
Diabetes Mellitus				
Yes	1	5.3%	1	4.8%
No	18	94.7%	20	95.2%
Clinical Characteristics				
Systolic Blood Pressure				
Mean±SD	126.3±4.7		126.9±6.2	
Diastolic Blood Pressure				
Mean±SD	82.1±3.8		81.6±3.7	

Table 2 The relationship between Mother's Age and the Incidence of Preeclampsia

Mother's Age	Category				P value
	Preeclampsia		Normal Pregnancy		
	n	%	N	%	
Age ≤ 35 years old	6	31.6%	3	14.2%	0.042*
Age >35 years old	13	68.4%	18	85.7%	

*significant

Table 3 The relationship between Mother's BMI and the Incidence of Preeclampsia

Mother's BMI	Category				P value
	Preeclampsia		Normal Pregnancy		
	n	%	N	%	
Normal	15	78.9%	16	76.2%	0.602
Obese	4	21.1%	5	23.8%	

BMI= Body Mass Index

Table 4 The relationship between Gravida Status and the Incidence of Preeclampsia

Mother's Gravida Status	Category				P value
	Preeclampsia		Normal Pregnancy		
	n	%	N	%	
Primigravida	2	10.5%	3	14.3%	0.664
Multigravida	17	89.5%	18	85.7%	

Table 5 The Relationship between Parity Status and the Incidence of Preeclampsia

Mother's Parity Status	Category				P value
	Normal		Preeclampsia		
	n	%	N	%	
Nullipara	2	10.6%	3	14.3%	
Primipara	10	52.6%	13	61.9%	0.661
Multipara	7	36.8%	5	23.8%	

Table 3 shows the relationship between mother's BMI and preeclampsia has no significant difference.

In table 4, the relationship between a mother's gravida status and preeclampsia indicates there is no significant difference.

Table 5 shows the relationship between a mother's parity status and preeclampsia has no significant difference.

Discussions

Hypertensive disorders are a common complication of pregnancy that puts women and their fetuses at disproportionate risk for further complications, as well as life-long sequelae. Hypertensive disorders of pregnancy include chronic hypertension—systolic blood pressure (BP) ≥140 mmHg or diastolic BP ≥90 mmHg that predates the onset of pregnancy; gestational hypertension—hypertension diagnosed after 20 weeks gestation without concurrent proteinuria; preeclampsia-eclampsia—classically, new-onset hypertension with new-onset proteinuria; and chronic hypertension

with superimposed preeclampsia—chronic hypertension with new-onset proteinuria or other signs/symptoms of preeclampsia after 20 weeks or chronic proteinuria with new-onset hypertension.[9,10]

Preeclampsia and eclampsia rank second or third in the world ranking of maternal morbidity and mortality causes. Preeclampsia affects 5% to 7% of all pregnant women but is responsible for over 70000 maternal deaths and 500000 fetal deaths worldwide every year. In an analysis implemented by the World Health Organization, which evaluated the causes of maternal death that occurred between 2003 and 2009, the hypertensive causes appear in the second place, occurring in 14% of the cases, preceded only by haemorrhagic causes, responsible for 27.1% of the maternal deaths.[9,11]

Many factors lead to an increased incidence of preeclampsia in pregnant women. Conditions that may result in preeclampsia include nullipara, multipara, age less than 20 years or more than 35 years, gemelli pregnancy, chronic hypertension, diabetes mellitus or kidney disease. Some studies also found primigravida, history of preeclampsia or eclampsia, pre-existing hypertension before pregnancy, and obesity as risk factors for preeclampsia. Rare risk factors are a family history of preeclampsia and mother carrying a trisomy 13 fetus. However, from these risk factors, it is still difficult to determine the most dominant factor.[9,12,13,14]

This study shows a significant relationship between maternal age and the incidence of preeclampsia (p=0.042), where women with age more than 35 years old tend to develop preeclampsia in their pregnancies. The results of this study were consistent with previous studies. [7,10,11,13,15–17] This could happen because of the physical weakness of the women started at this age, also it is possible women at this age to appear various risks of health disorders, such as high blood

pressure, diabetes, and various other diseases including preeclampsia.[13,18] At the age of 35 years or older, there will be changes in the tissue and reproductive organs and the birth canal are not flexible at this age.[17,19,20]

Obesity triggers the occurrence of preeclampsia through several mechanisms, i.e. the triggers of metabolites and other micro molecules. The risk of preeclampsia increased by 2-fold for weight gain of 5-7 kg/m^2. Also besides, it was found that increased risk of preeclampsia related to an increase in BMI. Women with a pre-pregnancy BMI of 35 kg/m2 or above have a 30% increased risk of developing PE.[7,13] However, the result showed no relationship between BMI and preeclampsia incidence with a p-value of 0.602. It is contradictory to the results of the research performed by Pogačnik (2018), Sambas (2019), and Rafida (2020), which mentioned that obese patients tend to undergo preeclampsia compared with normal BMI patients.[4,7,13]

Most of all 40 samples had multiple pregnancies in time of the study. The proportion of multigravida who suffers from preeclampsia is 8.5 times more than that of primigravida who suffers preeclampsia. However, gravida status did not affect preeclampsia incidence statistically. These bivariate analysis results are in line with Rafida (2020) and Denantika (2015), that there is no gravida relationship to preeclampsia incidence.[7,19] Meanwhile, according to Bratasena (2020) several predisposing factors for the occurrence of pre-eclampsia are uniqueness in pregnancy, especially primigravida. There are certain risk factor associated with disease progression: primigravida, grandemultigravida.[8] Theoretically, primigravida is more at risk for developing preeclampsia than multigravida because preeclampsia usually develops in women first exposed to chorionic villi. This happens because, in these women, the immunologic

mechanism for forming blocking antibodies carried out by HLA-G (human leukocyte antigen G) against placental antigens has not been fully developed. The trophoblast implantation process into maternal decidual tissue is disrupted. Will stimulate the body to secrete cortisol. Cortisol increases the sympathetic response, so cardiac output and blood pressure will also increase.[8,19]

The parity status of mothers does not have a significant relationship with the incidence of preeclampsia. Multipara tends to experience increased blood pressure during pregnancy. A normal pregnancy blood test result shows an increase in angiotensin, renin, and aldosterone as compensation so that blood circulation and metabolism can occur. Multipara is at risk of experiencing complications in terms of maternal mortality.[8,13] However, the result is contradictory to the results of the research performed Pogačnik (2018) which mentioned that multiparas had always a significantly lower incidence of preeclampsia.[4] The results showed that as much as 61.9% of respondents had parity of $\geq$ 3 times (multipara). This study indicates that there is a tendency for preeclampsia to occur in multiparous parity status, although there is no statistically significant relationship.

This study has several limitations because it is done retrospectively. Data on maternal preeclampsia conditions such as antenatal care visits and knowledge have not been measured. The severity of preeclampsia is still not differentiated, and the sample size is relatively small due to the unavailability of the patient for sampling. Besides, there is also the possibility of confusion in the diagnosis of preeclampsia, especially in pregnant women whose blood pressure before pregnancy or in early pregnancy is unknown; this makes it challenging to distinguish preeclampsia and chronic hypertension from superimposed preeclampsia. Thus, further study of these factors related to the incidence of preeclampsia.

It is necessary to increase education and counselling to mothers about the risk factors for preeclampsia and the dangers of preeclampsia. If the mother is overweight or obese, pregnancy can improve eating patterns and regular exercise. First-time pregnant women are advised to routinely control their pregnancies so that health workers can monitor maternal health development and increase preeclampsia screening as early detection for pregnant women at risk of preeclampsia.

Conclusions

There is no significant difference between BMI, gravida, and parity, with the incidence of preeclampsia. However, there is a significant relationship between the mother's age and the incidence of preeclampsia in Dr. Hasan Sadikin Hospital. This means mothers who are older than 35 years old tend to develop preeclampsia.

Conflict of Interest

The authors have no conflicts of interest to declare. We certify that the submission is original work and is not under review at any other publication.

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