

The Effect of Factors Causes Preeclampsia Towards Left Ventricle Mass Index on Preeclampsia Patient in Undata Regional Hospital of Palu

Pengaruh Faktor-Faktor Penyebab Preeklampsia terhadap Indeks Massa Ventrikel Kiri pada Pasien Preeklampsia di RSUD Undata Palu

Dilladini Nurul Ayu^{1*}, Tahir Abdullah², Syamsiar S Russeng³, Venice Chairiadi⁴

¹Students of Public Health Magister Program, Faculty of Public Health, Hasanuddin University

²Faculty of Public Health, Hasanuddin University

³Faculty of Public Health, Hasanuddin University

⁴Department of Cardiovascular, Undata Hospital Palu

*Korespondensi Penulis : nurulayudilladini@yahoo.co.id

Abstract

Background: Preeclampsia is an idiopathic multisystem disorder specific to pregnancy and the puerperium in which multiorgan abnormalities occur in at-risk pregnancies resulting in hypertension and multiorgan dysfunction in the form of an increase in left ventricular mass index which leads to diastolic heart failure.

Aim: Determine the relationship the effect of factors causes preeclampsia towards left ventricle mass index on preeclampsia patient in Undata Regional Hospital of Palu

Methods: This study used a cross sectional research approach. These variables are measured by research instruments where data can be analyzed according to statistical procedures.

Results: From total sample, there were pregnant women of abnormal age 37.67 years (27.3%) and normal age 28.12 years (72.7%) with a mean age of 30.73 ± 5.89 years with history preeclampsia. There were 21 patients (95.5%) with previous obesity and 1 patient (4.5%) had no history of obesity, 14 patients (63.6%) with a history of primigravida and 8 patients with multigravida (36.4%). One patient with multiple pregnancies (4.5%) and 21 patients (95.5% with no history of multiple pregnancies, 3 patients (13.64%) with chronic disease and 19 patients (86.36%) no history of chronic disease, There are 16 patients (72.7%) patients who use contraception and while 6 patients (27,3%) did not use contraception. Statistical tests risk factors for preeclampsia associated with cardiovascular disease events, hypertension which causes an increase in the Left Ventricle Mass Index (LVMI) it can be seen that in all preeclampsia patients causes uncontrolled hypertension and increase in LVMI above normal values (description according to table), the incidence of preeclampsia with a previous history of preeclampsia 1 (25%) showed a significant relationship with a value of $p = 0.001$.

Conclusion: Factors that cause significant preeclampsia, pregnant women who have a history of preeclampsia and who have a history of multiple pregnancies affect the occurrence of hypertension and an increase in left ventricular mass index.

Keywords: Preeclampsia; Risk Factors; Pregnant Women; Left Ventricle Mass Index

Abstrak

Latar Belakang: Preeklampsia merupakan kelainan multisistem idiopatik yang spesifik pada kehamilan dan masa nifas dimana terjadi kelainan multiorgan pada kehamilan yang berisiko mengakibatkan hipertensi dan disfungsi multiorgan berupa peningkatan indeks massa ventrikel kiri yang berujung pada gagal jantung diastolik.

Tujuan: Mengetahui hubungan pengaruh faktor penyebab preeklampsia terhadap indeks massa ventrikel kiri pada pasien preeklampsia di RSUD Undata Palu

Metode: Penelitian ini menggunakan pendekatan penelitian cross sectional. Variabel-variabel tersebut diukur dengan instrumen penelitian dimana data dapat dianalisis menurut prosedur statistik.

Hasil: Dari total sampel didapatkan ibu hamil dengan usia tidak normal 37,67 tahun (27,3%) dan usia normal 28,12 tahun (72,7%) dengan rerata usia $30,73 \pm 5,89$ tahun dengan riwayat preeklampsia. Terdapat 21 pasien (95,5%) dengan riwayat obesitas sebelumnya dan 1 pasien (4,5%) tidak memiliki riwayat obesitas, 14 pasien (63,6%) dengan riwayat primigravida dan 8 pasien dengan multigravida (36,4%). Satu pasien dengan kehamilan ganda (4,5%) dan 21 pasien (95,5% tanpa riwayat kehamilan ganda, 3 pasien (13,64%) dengan penyakit kronis dan 19 pasien (86,36%) tidak ada riwayat penyakit kronis, Terdapat 16 pasien (72,7%) pasien yang menggunakan kontrasepsi dan 6 pasien (27,3%) tidak menggunakan kontrasepsi Uji statistik faktor risiko preeklampsia yang berhubungan dengan kejadian penyakit kardiovaskuler, hipertensi yang menyebabkan peningkatan Left Ventricle Mass Index (LVMI) nya dapat dilihat bahwa pada semua pasien preeklampsia menyebabkan hipertensi yang tidak terkontrol dan peningkatan LVMI di atas nilai normal (gambaran sesuai tabel), kejadian preeklampsia dengan riwayat preeklampsia 1 sebelumnya (25%) menunjukkan hubungan yang bermakna dengan nilai $p = 0,001$.

Kesimpulan: Faktor penyebab preeklampsia yang signifikan, ibu hamil yang memiliki riwayat preeklampsia dan yang memiliki riwayat kehamilan ganda berpengaruh terhadap terjadinya hipertensi dan peningkatan indeks massa ventrikel kiri.

Kata Kunci: Preeklampsia; Faktor risiko; Wanita hamil; Indeks Massa Ventrikel Kiri

INTRODUCTION

As the evidence derived from retrospective and prospective epidemiological registries, partial pathophysiological insight, clinical studies, systematic reviews, and meta-analyses substantiating the association of preeclampsia and CVD has achieved level 1 (1).

Preeclampsia is becoming an increasingly common diagnosis in the developed world and remains a high cause of maternal and fetal morbidity and mortality in Indonesia. Preeclampsia is a multiorgan disorder in at-risk pregnancies that results in hypertension and multiorgan dysfunction. The incidence of preeclampsia is influenced by various risk factors including primigravida status, twin pregnancies, maternal age <20 years or >35 years at gestation, diabetes, pre-existing hypertension, preeclampsia in previous pregnancies, family history of preeclampsia, obesity, anxiety, antenatal care, contraceptive use and several other causes. There is growing evidence that these effects persist after pregnancy (2),(3),(4),(5),(6).

Preeclampsia in pregnancy can have adverse effects on both the mother and the fetus. Preeclampsia provides a higher risk of death from cardiovascular, kidney, liver, and other diseases. The maternal mortality rate in Indonesia is one measure of the quality of midwifery services and an essential public health indicator. Preeclampsia is a common pregnancy condition characterized by the onset of hypertension and proteinuria (3),(7). Many factors can increase the risk of preeclampsia in pregnancy. Prevention of preeclampsia can be done by identifying risk factors and closely monitoring women at risk to hope that the preeclampsia rate can be reduced. Preeclampsia is becoming an increasingly common diagnosis in developed countries and remains a significant cause of maternal and fetal morbidity and mortality in developing countries. The 2019 National Institute for Health and Care Excellence guidelines classify a woman at high risk of preeclampsia if there is a history of hypertensive disease during a previous pregnancy or maternal disease, kidney disease, autoimmune disease, diabetes, or chronic hypertension (8),(9).

Hypertensive disorders of pregnancy, an umbrella term that includes preexisting and gestational hypertension, preeclampsia, and eclampsia, complicate up to 10% of pregnancies and represent a significant cause of maternal and perinatal morbidity and mortality (10). Preeclampsia is associated with asymptomatic global left ventricular abnormal function and geometry during the acute phase of the disorder. We evaluate and quantify the evidence on the relationship between preeclampsia and the future risk of cardiovascular diseases. Preeclampsia is an idiopathic multisystem disorder specific to pregnancy and the puerperium in which multiorgan abnormalities occur in at-risk pregnancies resulting in hypertension and multiorgan dysfunction in the form of an increase in left ventricular mass index which leads to diastolic heart failure. In this study, all the risk factors were analyzed simultaneously so that the relationship with the incidence of preeclampsia could be identified (7),(11).

MATERIAL AND METHOD

This study used a quantitative research approach. Quantitative research is a method for testing certain theories by examining the relationships between variables. These variables are measured by research instruments so that data consisting of numbers can be analyzed according to statistical procedures. The case population in this study were all pregnant women diagnosed with preeclampsia who were treated at Undata Palu Hospital. This research was conducted in the Echocardiography of Undata Hospital, the Obstetrics Room of Undata Hospital and the Medical Records Sub-Division of UNDATA Regional General Hospital Palu, Central Sulawesi. Because this research used total sampling, the duration of the research will be carried out until the required sample is sufficient for the research analysis method. The number of patients studied was 22 pregnant women with preeclampsia. Data processing using univariate, bivariate analysis with Chi-square test, and multivariate analysis with multiple logistic regression

RESULTS

From the table it is known that the research subjects consisted of pregnant women of abnormal age 37.67 years (27.3%) and normal age 28.12 years (72.7%) with an average age of 30.73 ± 5.89 years with risk factors for preeclampsia, history of obesity previously there were 21 patients (95.5%) and had no previous history of obesity 1 patient (4.5%), history of primigravida pregnancy there were 14 patients (63.6%) and multigravida 8 patients (36.4%), history of pregnancy there were 1 patient (4.5%) with multiple pregnancies and 21 patients (95.5%) had no history of multiple pregnancies, 3 patients with a history of chronic disease (13.64%) and 19 patients who did not have a history of chronic disease (86, 36%), history of contraception 16 patients (72.7%) and those who did not use contraception 6 patients (27.3%).

Table 1. Patients characteristic

Characteristic	Frequency	Percentage (%)
AGE	22	30,73 ± 5,89
Abnormal	6	27,3
Normal	16	72,7
Pregnancy History		
1- 3	14	63,6
≥ 4	8	36,4
Gemelli Pregnancy		
Yes	1	4,5
No	21	95,5
Chronic Disease History		
Yes	3	13,64
No	19	86,36
IMT		
Overweighth	1	4,4
Obesity type 1	15	68,2
Obesity type 2	6	27,3
Contraceptive History		
Yes	12	54,55
No	10	45,45

Statistical analysis factors associated preeclampsia and uncontrolled hypertension which causes an increase in Left Ventricle Mass Index (LVMI) showed that in all preeclampsia patients to experience uncontrolled hypertension and ultimately causes an increase in LVMI above normal values the incidence of preeclampsia with a previous history of preeclampsia was 1 patient (25%), there was a significant relationship with a value of $p = 0.001$, the analysis results obtained an odds ratio (OR) = 0,02, which means that pregnant women who have history of preeclampsia have a 0.02 risk of getting preeclampsia, history of gmelli pregnancy 1 people (100%) $p = 0.03$, pregnant women with abnormal age 1 patient (4.5%) $p = 0.91$, 2 patients with a history of more than 4 pregnancies (9.1%) $p = 0.531$, 12 patients with a history of contraception use (75%) $p = 0.176$, 17 patients with a history of obesity (81%) $p = 0.629$, and 2 patients with a history of chronic disease (66.7%) $p = 0.464$.

Table 2.

Risk factor	Yes		No		P-value	Crude OR (95% CL)
	N	%	N	%		
Age						
- Normal	3	13,60%	5	59,10%	0,91	0,867 (0,072 - 10,423)
- Abnormal	1	4,50%	13	22,70%		
Pregnant						
- Yes	2	9,10%	6	27,30%	0,53	0,5 (0,56 - 4,473)
- No	2	9,10%	12	54,50%		
History of Preeclampsia						
- Yes	1	25%	3	75%	0	0,02 (0,001 - 0,406)
- No	17	94,40%	1	5,60%		

Gmeli						
- Yes	0	0%	1	100%		0,143
- No	18	85,70%	3	14,30%	0,03	(0,050 - 0,407)
Contraceptive History						
- Yes	12	75%	4	25%		1,333
- No	6	100%	0	0%	0,18	(1,005 - 1,769)
Obesity						
- Yes	17	81%	4	19%		1,235
- No	1	100%	0	0%	0,63	(1,004 - 1,520)
Chronic Disease						
- Yes	2	66,70%	1	33,30%		2,667
- No	16	84,20%	3	15,80%	0,46	(0,179 - 39,626)

Multivariate analysis was carried out on both factors, namely history of preeclampsia and history of multiple pregnancies associated with hypertension and increased LVMI. The analysis results show that there is a significant relationship between history preeclampsia with the incidence of hypertension ($p=0.002$) and increased LVMI ($p=0.004$), while the results obtained from multiple pregnancies for hypertension ($p=0.003$) and an increase in LVMI ($p=0.001$), both show significant results and are presented in the following table:

Table 3.

Significant Risk Factors	P- Value	
	Hipertension	LVMI Increased
History of Preeclampsia	0,002	0,004
Gmeli	0,003	0,001

DISCUSSION

Preeclampsia is one of the causes of perinatal morbidity and mortality in Indonesia. Heart disease is the leading cause of death in women in all countries. A history of pre-eclampsia, one of the most deadly hypertensive complications of pregnancy, increases cardiovascular risk by two to four times, which is comparable with the risk induced by smoking (12). The incidence of preeclampsia is influenced by various risk factors including primigravida status, twin pregnancies, maternal age <20 years or >35 years at gestation, diabetes, pre-existing hypertension, preeclampsia in previous pregnancies, family history of preeclampsia, obesity, anxiety, antenatal care, contraceptive used and several other causes. In this study the risk factors were analyzed simultaneously so that the relationship with the incidence of preeclampsia could be identified (9).

A history of preeclampsia with hypertension in pregnancy is associated with an increase in left ventricular mass index. Preeclampsia is accompanied by concentric left ventricular remodeling along with diastolic dysfunction and reduced cardiac contractility. This could be explained by the increased duration of hypertension being longer (3 months or more). Pregnant women with preeclampsia have significant systolic and diastolic dysfunction compared to normotensive controls. Blood pressure monitoring alone is not sufficient to effectively identify the risk of cardiovascular complications in these subjects (13). Left ventricular hypertrophy (LVH) is a condition in which an increase in left ventricular mass occurs secondary to an increase in wall thickness, an increase in left ventricular cavity enlargement, or both. 14 In individuals with hypertension, especially older

women, exuberant hypertrophy develops, wall stress is subnormal, and ejection performance is normal or supernormal (15). Diagnosis of LVH depends predominantly on echocardiographic measurements or novel noninvasive imaging techniques. Methods for 2D targeted M-mode echocardiographic measurements of LV dimensions and the calculation of LV mass are standardized and have been reported in detail elsewhere.¹⁵ Subset of preeclamptic patients with echo changes who are at higher risk of developing cardiovascular complications later in life by undergoing echocardiography (16). These findings support guidelines recommending close monitoring of hypertension in women with preeclampsia during pregnancy and setting the stage for longitudinal echocardiographic studies to better elucidate the development of LV geometry and function after pregnancy. In cases of chronic hypertension due to preeclampsia it will cause ventricular hypertrophy due to excess pressure on the left ventricle which has a major impact on the cardiovascular system in general called changes in ventricular geometry. During pregnancy, heart develops physiological left ventricular hypertrophy as a result of the natural volume overload. This is referred to as a concentric remodeling process that is related to the wall thickness and left ventricular chamber volume. Long-standing hypertension in cases of preeclampsia is known to cause long-lasting chronic overload which in turn induces important structural changes in the ventricular myocardium (17).

Preeclampsia is now recognized in society guidelines as a CVD risk enhancer. The International Society for the Study of Hypertension in Pregnancy (ISSHP) recommends that women with strong clinical risk factors for preeclampsia (ie, previous occurrence of preeclampsia, chronic hypertension, pregestational diabetes mellitus, maternal body mass index >30 kg/m², mandatory antiphospholipid syndrome) receive attention with preventive measures to prevent cardiovascular risk and prevent increased mortality rates in the future (11),(18),(19).

The results of multiple logistic regression analysis showed that the most influential risk factors for preeclampsia were history previous history of preeclampsia, hypertension, and diabetes mellitus. Based on the results of this study, it can be seen that previous preeclampsia significantly influenced the incidence of preeclampsia. Previous research also showed that mothers with a previous history of preeclampsia had an influence on the incidence of preeclampsia. Mothers with previous preeclampsia have the potential to experience preeclampsia again up to 3 times greater than pregnant women without previous preeclampsia. Hypertension significantly affects the incidence of preeclampsia. The results of this study should be considered when assessing and managing women with a personal or family history of hypertension who are planning a pregnancy. Targeted control of elevated BP has an especially important potential to reduce the risk of complications for both the mother and the child (20).

Women who experience hypertension in pregnancy have a larger left ventricular size, a thicker left ventricular wall and a larger LV mass than women with a normotensive pregnancy. In several large echocardiographic studies of patients with hypertension or without predisposition to hypertension, a history of pregnancy with hypertension and preeclampsia was associated with a higher left ventricular mass index and a higher prevalence of left ventricular hypertrophy compared with women without a history of pregnancy with preeclampsia and hypertension. The greater the size of the left atrium and the filling pattern of the left ventricle observed using an echocardiographic approach indicates a higher prevalence of impaired diastolic function after chronic hypertension. In pregnancies complicated by preeclampsia, especially early-onset preeclampsia, the diastolic LV function is impaired. This study shows that hypertension in pregnancy can be a risk factor for left ventricular hypertrophy several decades after pregnancy with coexistence of preeclampsia and hypertension. In comparison with women who had a normotensive pregnancy, women with a history of preeclampsia demonstrated a trend toward altered cardiac structure and function.²¹ Women with pregnancy induced hypertension had higher left ventricle mass index and relative wall thickness compared with normal pregnant women (22). An echocardiographic study performed within one year reporting preeclamptic pregnancies and hypertension demonstrated persistent left ventricular geometric changes in which concentric remodeling, eccentric or concentric hypertrophy and diastolic dysfunction occurred one year postpartum (13).

In this study, we evaluated the role of echocardiography in preeclampsia and found that there are changes in left ventricular anatomy. In normal pregnancy, increased preload and decreased afterload promote better left ventricular emptying during systole and reduced systolic pressure at the end of the left ventricular emptying phase. In preeclamptic women, increased afterload is associated with reduced left ventricular emptying and increased end-systolic pressure. In pregnancies complicated by preeclampsia, especially early-onset preeclampsia, the diastolic LV function is impaired (23). In these studies, women that later developed preeclampsia had a higher peripheral vascular resistance and a lower cardiac output compared with women with subsequent normal pregnancies (24). In our study, we found that there was an increase in the mean left ventricular mass index above the normal value. The results of this study found that the left ventricular diastolic mass was significantly higher than most people without preeclampsia. In pregnant women with preeclampsia, a significant increase in blood pressure will lead to a high increase in total vascular resistance (TVR) and show an increase in afterload associated with reduced left

ventricular emptying. The increase in end systolic volume indicates that the increase in end systolic pressure results from an increase in afterload. Excessive left ventricular (LV) mass (LVM) increase results in inefficient LV work with high energy waste and a negative prognostic effect (25). Women with a history of preterm preeclampsia may benefit from formal cardiovascular risk assessment in the 1 to 2 years after delivery to identify those who would benefit from targeted therapeutic intervention (26). There is currently wide variation in practice over use of antihypertensive treatment in the postnatal period, and these recommendations may reduce LVM increase variation in practice (27). Management of diastolic dysfunction after preeclampsia in the first semester is very important to prevent cardiovascular problems. From this study the importance of echocardiographic examination by assessing LVMI is considered to evaluate clinical progress post-treatment more than 16 weeks. Echocardiographic measurement of left ventricular mass was significantly reduced after 16 weeks treatment (26),(28).

CONCLUSION

The increase in Left Ventricular Mass Index / LVMI is caused by an increase stroke volume which is the result of an increase in blood pressure above the normal value in the last 3 months of pregnancy. The incidence of preeclampsia in patients caused by various factors such as age over 35 years, multiparous pregnancy, previous chronic disease, multiple pregnancies (gmelli) and the incidence of preeclampsia in previous pregnancies play an important role in the occurrence of preeclampsia which ultimately results in an increase in uncontrolled blood pressure then causes an increase in left ventricular mass index (LVMI). If this is allowed to continue it will cause continuous left ventricular hypertrophy and result in diastolic dysfunction which is the initial phase of heart failure.

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AUTHOR CONTRIBUTIONS

D.N.A designed the model and the computational framework and analysed the data. A.T And S.R.S Research Supervisors, C.V. Echocardiographic Evaluation and performed the calculations. D.N.A wrote the manuscript with input from all authors.

CONFLICTS OF INTEREST

In writing this journal the author states that there is no conflict of interest either personally or institutionally. The author also states that every name listed in this study has a very large contribution, the role of the research supervisor starts from determining the research title, research design, analysis and interpretation of research results. Also the role of the cardiologist who assisted in conducting echocardiographic examinations was very helpful in completing this study.

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