The Different of Resistance Index (RI) and Pulsatility Index (PI) Uterine Arterybetween Early Onset Severe Preeclampsia and Late Onset Severe Preeclampsia

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Abstract

Objective: To know the means differences for Uterine artery Resistance Index (RI) and Pulsatility Index (PI) between Early onset severe preeclampsia and late onset severe preeclampsia.

Method: This is cross sectional study, perform in Fetomaternal examination room and delivery room of M. Djamil Central Hospital from January – October 2012. Uterine artery Resistance Index (RI) and Pulsatility Index (PI) is examine with Doppler Ultrasound and with statistic analysis the difference between early and late onset severe preeclampsia is count.

Result: The means of Resistance Index (RI) in early onset severe preeclampsia is 0,70 for right uterine artery and 0,87 for left uterine artery. The means of Resistance Index (RI) in late onset severe preeclampsia is 0,75 for right uterine artery and 0,69 for left uterine artery. The means of Pulsatility Index (PI) in early onset severe preeclampsia is 2,58 for right uterine artery and 1,42 for left uterine artery. The means of Pulsatility Index (PI) in late onset severe preeclampsia is 2,74 for right uterine artery and 2,05 for left uterine artery. There is no statistical deference ($p>0,05$) for Resistance Index (RI) and Pulsatility Index (PI) between early onset severe preeclampsia and late onset severe preeclampsia.

Conclusion: There is means deference for Resistance Index (RI) and Pulsatility Index (PI) between early onset severe preeclampsia and late onset severe preeclampsia although there is no statistical deference.

Key Words: Resistance Index, Pulsatility Index, Early Onset, Late Onset

Abstrak

Tujuan: Mengetahui perbedaan nilai rata-rata Indeks Resistensi (IR) dan Indeks Pulsatilitas (IP) Arteri Uterina pada Preeklampsia Berat Onset Dini dan Preeklampsia Berat Onset Lanjut

Metode: Penelitian ini adalah observasional dengan rancangan potong lintang. Penelitian dilakukan di ruang pemeriksaan Fetomaternal dan Kamar Bersalin RS. Dr. M. Djamil Padang selama bulan Januari - Oktober 2012. Dilakukan pemeriksaan Indeks Resistensi (IR) dan Indeks Pulsatilitas (IP) Arteri Uterina dengan USG Doppler dan dilakukan perhitungan beda nilai rata-rata antara kelompok Preeklampsia Berat Onset Dini dengan Preeklampsia Berat Onset Lanjut.

Hasil: Nilai rata-rata Indeks Resistensi (IR) Preeklampsia Berat Onset Dini adalah 0,70 untuk arteri uterina kanan dan 0,87 untuk arteri uterina kiri. Nilai rata-rata Indeks Resistensi (IR) Preeklampsia Berat Onset Lanjut adalah 0,75 untuk arteri uterina kanan dan 0,69 untuk arteri uterina kiri. Nilai rata-rata Indeks Pulsatilitas (IP) Preeklampsia Berat Onset Dini adalah 2,58 untuk arteri uterina kanan dan 1,42 untuk arteri uterina kiri. Nilai rata-rata Indeks Pulsatilitas (IP) Preeklampsia Berat Onset Lanjut adalah 2,74 untuk arteri uterina kanan dan 2,05 untuk arteri uterina kiri. Tidak terdapat perbedaan yang bermakna ($p>0,05$) antara nilai rata-rata Indeks Resistensi (IR) dan Indeks Pulsatilitas (IP) Arteri Uterina pada Preeklampsia Berat Onset Dini dengan Preeklampsia Berat Onset Lanjut

Kesimpulan: Terdapat perbedaan nilai rata-rata Indeks Resistensi (IR) dan Indeks Pulsatilitas (IP) Arteri Uterina pada Preeklampsia Berat Onset Dini dengan Preeklampsia Berat Onsel Lanjut, namun secara statistik tidak bermakna ($p>0,05$)

Kata kunci: Indeks Resistensi, Indeks Pulsatilitas, Onset Dini, Onset Lanjut

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Introduction

Hypertensive disorders complicate 5 to 10 percent of all pregnancies, and together they form one member of the deadly triad, along with hemorrhage and infection, that contribute greatly to maternal morbidity and mortality rates. With hypertension, the *preeclampsia syndrome*, either alone or superimposed on chronic hypertension, is the most dangerous. The World Health Organization systematically reviews maternal mortality worldwide (Khan and colleagues, 2006). In developed countries, 16 percent of maternal deaths were due to hypertensive disorders. [1-2]

Blood flow velocity has been proofed that pregnancy hypertension complicated with intra uterine growth restriction have correlation with impaired uteroplacental circulation. Impaired uteroplacentalcirculation caused by abnormal change of spiral artery histomorfologywhich can be diagnosed using Doppler Ultrasound. [2-4]

Doppler examination of uteroplacental circulation abnormalities reflect uteroplacental circulation, and because Doppler examination were eligible for a screening examination, then in theory can be used as an optimal method for early prediction caused this abnormality. [5-8]

Pulsatilitas of wave velocity initially assessed using Doppler ultrasound in the peripheral vascular system. Gosling and King (1975) (quoted by DevMaulik, 2005) were the first to develop Pulsatilitas index (IP) by measuring the difference between the systolic pulse with diastolic velocity. Pulsatilitas index (IP) was first raised in the form of data by Fourier (quoted from DevMaulik, 2005), known as Fourier IP. Followed by a more modest, with an IP from peak to peak, which is based on changes in the frequency of peak systolic wave (S), the end diastolic frequency shift (D), and the maximum frequency temporal changes in the cardiac cycle (A). [9]

Based when the manifestations of preeclampsia, preeclampsia can be classified into early onset preeclampsia that occur before 34 weeks of gestation (other literature write <32 weeks) and late onset preeclampsia arising after 34 weeks (> 32 weeks). [10-11]

Current research is beginning to discover if early onset and the late onset of preeclampsia further has a different pathophysiology. Indicated if the early onset preeclampsia (<34 weeks) is often associated with higher morbidity and perinatal and maternal mortality, due to the early onset preeclampsia was found impaired uteroplacental perfusion (increased resistance uteroplacental flow). While the advanced onset preeclampsia (> 34 weeks) is often associated with extrinsic factors such as the size of the larger placental. [1,11]

Expected if early onset severe preeclampsia (before 34 weeks) and the onset severe preeclampsia has a different etiology that further clinical manifestations are different, but the theory is still in the

research stage. From various previous studies, there are several fundamental differences among which the onset severe preeclampsia which is a further 80% of cases and most cases of preeclampsia associated with fetal growth either in the absence of signs of impaired fetal growth with an overview of uterine artery Doppler velosimetri normal or slightly increased, where there is no interruption of blood flow umbilicus and more risky in women with placenta were large and spacious (diabetes, multiple pregnancy, anemia).[12]

Early onset severe preeclampsia which is 5-20% of all severe preeclampsia, but it often leads to severe clinical cases, which correlated significantly with abnormal trophoblast invasion of the spiral arteries, causing changes in blood flow in the arteries subplasenta, increased placental blood flow resistance and umbilical artery and signs of impaired fetal growth.[12]

Therefore, researchers wanted to know Is there a difference in the average value Pulsatility Index (PI) and Resistance index (RI) in the uterine arteries which is the most reliable and best describes the morphology of the spiral arteries abnormalities between early onset severe preeclampsia with late onset preeclampsia.

Method

This is cross sectional study with 16 patient early onset severe preeclampsia and 16 patient late onset severe preeclampsia.All samples were obtained from Dr. M. Djamil Hospital Padang from January to October 2012.

The sample is the entire population of the approved affordable for velosimetri Doppler examination of uterine arteries and agree to participate as a research subject and meet the inclusion and exclusion criteria.The research sample was taken at random (random) sampling using consecutive sampling, ie each singleton pregnancies of patients who were treated in the maternity hospital. DR. M. Djamil Padang with a diagnosis of severe preeclampsia were included in the sample until the number of sample met. Determination of the number of samples using formula to find the average difference between the two populations.Inclusion criteria were pregnant women who were treated in the Dr. M. Djamil Padang hospital with a diagnosis of severe preeclampsia, single pregnancy, willing to follow the study.

Research subjects were divided into 2 groups: early onset severe preeclampsia group (gestational age <34 weeks) and the late onset severe preeclampsia (≥ 34 weeks gestation). All samples from the two groups in accordance with the inclusion, then the measured Resistance Index (RI) and Pulsatility Index (PI) uterine arteries.

Velosimetri measurements performed after the patient be managed as severe preeclampsia that is, after the initial dose given MgSO4 regimen and the maintenance dose regimen MgSO4. On the subject of the research performed

uterine artery Doppler examination velosimetri using ultrasound equipment brands Aloka α10 type using abdominal transducer, wherein the transducer is directed into the iliac fossa using PW Doppler (Pulsed Wave Doppler) real time so that the structure of the main branches ascending uterine arteries imaged and measured velosimetri indices (RI and PI).

Data analysis using SPSS computer program to find whether there is a difference in the average value of Resistance Index (RI) and Pulsatility Index (PI) uterine arteries between early onset severe preeclampsia with onset up.

Result

Patient age of the sample for both groups between early onset preeclampsia with late onset severe preeclampsia, there is no difference of age distribution, with an age range from 16 years to 42 years. From the characteristics of antenatal care most of the samples do antenatal care in midwife (> 50%). From the characteristics of the mother's education is the most junior (50%) for advanced onset preeclampsia and high school (50%) for early onset preeclampsia. Characteristics most jobs are housewives (62.5% in early onset preeclampsia group and 81.3% in the advanced onset preeclampsia.

Table 1: Sample Characteristic

Patient Characteristic with Severe Preeclampsia		Gestational Age		Total
		<34 weeks	=34 weeks	
Patient Age (year)	<20	1 (6.3%)	1 (6.3%)	2 (6.3%)
	20-30	6 (37.5%)	6 (37.5%)	12 (37.5%)
	31-40	7 (43.8%)	7 (43.8%)	14 (43.8%)
	>40	2 (12.5%)	2 (12.5%)	4 (12.5%)
Antenatal Care	Midwife	11 (68.8%)	12 (75%)	23 (71.9%)
	Public health service	0 (0%)	3 (18.8%)	3 (9.4%)
	Hospital	1 (6.3%)	0 (0%)	1 (3.1%)
	Obstetrician	4 (25%)	1 (6.3%)	5 (15.6%)
Education	Elementary School	4 (25%)	1 (6.3%)	5 (15.6%)
	Junior High School	0 (0%)	8 (50%)	8 (25%)
	Senior High School	8 (50%)	5 (31.3%)	13 (40.6%)
	Diploma	3 (18.8%)	1 (6.3%)	4 (12.5%)
	Graduated	1 (6.3%)	1 (6.3%)	2 (6.3%)
Occupation	House wife	10 (62.5%)	13 (81.3%)	23 (71.9%)
	Civil servant	2 (12.5%)	2 (12.5%)	4 (12.5%)
	Farmer	2 (12.5%)	0	2 (6.3%)
	Private	2 (12.5%)	0	2 (6.3%)
	College student	0 (0%)	1 (6.3%)	1 (3.1%)

Table 2: Resistance Index (RI) and Pulsatility Index (PI) Result.

		Gestational Age	
		<34 weeks	≥34 weeks
RI Right Uterine Artery	N	10	16
	Mean	0.7020	0.7600
	Std. Deviation	0.12822	0.24266
	Std. Error Mean	0.04056	0.06066
RI Left Uterine Artery	N	10	16
	Mean	0.8730	0.6931
	Std. Deviation	0.37883	0.34941
	Std. Error Mean	0.1980	0.08735
PI Left Uterine Artery	N	10	16
	Mean	1.4170	2.0638
	Std. Deviation	0.67718	1.74942
	Std. Error Mean	0.21414	0.43686
PI Right Uterine Artery	N	10	16
	Mean	2.5880	2.7400
	Std. Deviation	2.84204	3.70273
	Std. Error Mean	0.89873	0.92568

The result of the resistance index (RI) uterine arteries in early onset severe preeclampsia and late onset severe preeclampsia showed there was no statistical difference although there are differences in the average value of the index where the resistance to the left uterine artery was found in early-onset severe preeclampsia (0.87) is much more high compared to the late onset severe

preeclampsia (0.69).Examination results pulsatilitas index (IP) uterine arteries in early onset severe preeclampsia and severe preeclampsia showed there was no significant difference statistically.

Table 3: Statistic Analysis

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference		Lower	Upper
RI.UKa	Equal variances assumed	1.468	.237	-.574	24	.571	-.04800	.08358		-.22045	.12445
	Equal variances not assumed			-.658	23.559	.517	-.04800	.07297		-.19874	.10274
RI.UTKi	Equal variances assumed	.643	.430	1.237	24	.228	.17988	.14541		-.12024	.47999
	Equal variances not assumed			1.213	18.053	.241	.17988	.14826		-.13155	.49130

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference		Lower	Upper
PI.UKi	Equal variances assumed	2.803	.107	-1.097	24	.283	-.63675	.58021		-1.83425	.56075
	Equal variances not assumed			-1.311	21.070	.204	-.63675	.48562		-1.64645	.37295
PI.UKa	Equal variances assumed	.152	.700	-.111	24	.913	-.15200	1.37283		-2.98537	2.68137
	Equal variances not assumed			-.118	22.817	.907	-.15200	1.29020		-2.82216	2.51818

Discussion

Age distribution of the sample is the same for both groups showed a statistically both groups had an age distribution did not differ (Table 1). With the uneven distribution of the age of the samples in the two groups, it is expected that homogeneous samples for both study groups.

Antenatal care (ANC) for early onset severe preeclampsia group and the onset is the most advanced midwife (68.8% and 75.0%) shows if the ANC did not affect the incidence of onset severe preeclampsia (Table 1). Maternal education distribution of the two groups showed a fairly uniform distribution with an average maternal education was high school (Table 1). The work that most mothers are housewives 62.5% for early onset severe preeclampsia and 81.3% for late onset severe preeclampsia (Table 1).

Various studies have shown that the Doppler flow impedance in the uterine arteries is increased in patients with preeclampsia condition especially in early onset preeclampsia. Currently, Doppler ultrasound in obstetrics velocimetry used as a non-invasive method to evaluate the function of placental circulation.and many studies have been done using this technology to predict pregnancy and its complications.[13-14]

The data showed the average value of resistance index (RI) uterine arteries in early onset severe preeclampsia and late onset severe preeclampsia showed there was difference. For the early onset severe preeclampsia found the average value of RI uterine arteries was 0.87 higher compared to the average value of RI uterine arteries at late onset severe preeclampsia just 0.69. However, from a statistical test to find the average difference between the two groups of samples, this difference was not significant (p> 0.05). These results are consistent with previous studies including research conducted by Melchiorre 2008.

Melchiorre et al (2008) conducted a study to determine the relationship between uterine artery Doppler in the first trimester with the occurrence of preeclampsia. Melchioreexamine uterine artery Doppler in 3058 singleton pregnancies that included 57 and 33 cases of pre-eclampsia, preterm and term. Obtained value of resistance index (RI) were significantly higher in pregnant

women with preterm preeclampsia occurs (IR: 0.79) compared with normal pregnancies (IR: 0.70) and preeclampsia that occurs during pregnancy at term (IR: 0.72).[15]

The study's findings are consistent with previous studies in which the high resistance of the uterine arteries in early-onset severe preeclampsia as described earlier regarding the pathogenesis of early onset preeclampsia, which is associated with the abnormal trophoblast invasion of the spiral arteries and changes in blood flow in the arteries subplasenta. In contrast to the onset severe Preeclampsia, which is a further 80% of cases of preeclampsia and associated with uterine artery Doppler images velosimetri normal or slightly elevated and there is no interruption of blood flow umbilicus.[12]

While research data for Pulsatilitas Index shows the average value pulsatilitas index (PI) in early onset severe preeclampsia is 2,58and for onset severe preeclampsia-up was 2,74. These results showed no statistically significant difference (p> 0.05). This finding is slightly different from the results of previous studies.

Soares and colleagues (2007) conducted a study to determine the relationship between uterine artery Doppler examinations in the first trimester of pregnancy with the occurrence of spontaneous preterm delivery. Uterine artery Doppler examinations performed at 11-14 weeks of gestation in pregnant women only in Unit FetomaternalSt.George University in London. Soares found the average Pulsatility index for preeclampsia before 34 weeks was 1.56 while in preeclampsia after 34 weeks was 1.42 with a standard deviation of 0.24.[16]

This difference can be explained by the presence of difference in the methods of research conducted. Some differences can cause varying results include the differences in the ionization method of uteroplacental circulation, the different blood vessels inspected, cut to the index value difference Pulsatility (PI), the number of samples in this study were limited, and differences in the way the selection of patients.

Conclusion

There are differences in the average resistance index (RI) and Pulsatility Index (PI) between early onset severe preeclampsia with late onset severe preeclampsia, although it was no statistically difference.

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