Correlation between Seasons and the Prevalence of Preeclampsia at Tertiary Hospital, Indonesia

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Abstract

Background: Preeclampsia is the second most common cause of maternal mortality following postpartum hemorrhage. In East Java alone the maternal mortality rate due to preeclampsia was 31%. Some studies explain that the incidence of preeclampsia can be caused by seasonal variations, whereas other studies say that seasonal factors can be a protective factor for preeclampsia.

Objective: To find out how seasons relate to the prevalence of preeclampsia.

Method: A descriptive analytic study using medical record data during. The sample meets the inclusion criteria, namely pregnant women with preeclampsia, severe preeclampsia, chronic hypertension with superimposed severe preeclampsia, or eclampsia. The exclusion criteria were pregnant women with chronic hypertension or gestational hypertension. The sampling technique used was total sampling and cross-sectional design with observation method using secondary data from medical records. Data was processed using IBM SPSS Statistics and presented narratively.

Results: Respondents who experienced preeclampsia in the dry season were 558 people or 19.3% and those who did not experience preeclampsia were 844 people or 29.2% The results of data analysis with statistical tests using Chi-Square obtained a significance value or p-value of 0.091 (p> 0.05).

Conclusion: No correlation between seasonality and the prevalence of preeclampsia.

***Keywords**: preeclampsia, rainy season, dry season*

Introduction

Pregnancy Induced Hypertension (PIH), including gestational hypertension, preeclampsia and eclampsia, is a complication in pregnancy that makes an important contribution to maternal and perinatal morbidity and mortality worldwide[1,2]. The pathophysiology of PIH is not fully understood, but several risk factors are known, including primipaternity, multifetal pregnancy, chronic hypertension, a history of previous preeclampsia and family history, gestational diabetes mellitus and thrombophilia. Environmental factors also appear to have a role in the pathogenesis of PIH[3].

The effect of environmental conditions such as temperature, relative humidity of the air and the seasons of the year on the incidence of diseases has been recognized since the time of Hippocrates and is easily perceptible in infectious diseases[4]. In recent years, observations on the effect of environmental conditions on the incidence of preeclampsia have been documented. Although these remain controversial, recent systematic review on the subject found mostly consistent evidence of seasonal variation in the occurrence of the hypertensive disorders of pregnancy in both tropical and non-tropical regions[5].

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The pathogenesis, pathophysiology and pathological changes in the function of organs in preeclampsia have been widely discussed, but none have satisfactory results. There are many factors that explain the occurrence of PIH and several studies include seasonal trends as factors that can contribute to environmental risk factors for PIH. From research that study how seasonal trends can affect the occurrence of PIH, results are obtained with considerable diversity. This diversity is partly due to differences between populations, regions of the world and climate in which immunological factors also have a role5[5,6]. This research to find out the relationship between the seasons in Indonesia (rainy and dry seasons) and the prevalence of preeclampsia (preeclampsia, severe preeclampsia, chronic hypertension with severe preeclampsia and eclampsia).

Method

This research is a descriptive analytic study which uses medical record data at Dr. Soetomo Teaching Hospital from January 2017 to December 2018. The research design was cross-sectional design using observation method, which was collecting secondary data in the form of medical records (MR) that was processed using IBM SPSS Statistics Version 20.

The population of this study were women who underwent delivery (vaginally or abdominally) at Dr. Soetomo Teaching Hospital in 2017-2018. The inclusion criteria include pregnant women diagnosed with (1) preeclampsia, (2) severe preeclampsia, (3) chronic hypertension with superimposed severe preeclampsia, or (4) eclampsia. The exclusion criteria in this study were pregnant women diagnosed with chronic hypertension and gestational hypertension.

The instrument used in this study was the medical record of all pregnancies with preeclampsia, severe preeclampsia, chronic hypertension with superimposed severe preeclampsia and eclampsia. Total sampling of pregnant women with a diagnosis of preeclampsia was recorded in 2017-2018. The collected data was processed and presented in tabular and narrative form.

Results and Discussion

Distribution of season frequency and respondent characteristics

The total of samples in this study was 2887 respondents, 1485 respondents or 51.4% of which were from the rainy season and in the dry season were 1402 respondents or 48.6%. And then it was found that respondents who experienced preeclampsia were 1195 people or 41.4% and respondents who did not experience preeclampsia were 1692 people or 58.6%.

The Correlations between seasons and preeclampsia

Based on the results of the cross tabulation in the table, it can be seen that number of respondents who experienced preeclampsia in the rainy season were 637 people or 22.1%, while those who did not experience preeclampsia were 848 people or 29.4%. The results of data analysis with statistical tests using Chi-Square obtained a significance value or p-value of 0.091 ($p>0.05$), meaning that there is no significant relationship between seasons and the incidence of preeclampsia.

Table 1: The Correlations between seasons and preeclampsia

			Preeclampsia		Total	P
			Yes	No		
Season	Rain	Count	637	848	1485	0.091*
		%	22.1%	29.4%	51.4%	
	Dry	Count	558	844	1402	
		%	19.3%	29.2%	48.6%	
Total		Count	1195	1692	2887	
		%	41.4%	58.6%	100.0%	

Characteristics of respondents by preeclampsia cases based on age in rainy season

Based on age group, it is known that from a total of 2887 respondents, respondents aged less than or equal to 16 years were 23 people or 0.8%, respondents aged 17-34 years were 1992 people or 69.0%, and respondents aged over or equal to 35 years were 872 people or 30.2%.

Preeclampsia cases based on age in dry season

Based on the SPSS calculation results, it is known that from a total of 558 respondents with preeclampsia in the dry season, 4 respondents or 0.3% were aged below or equal to 16 years, respondents aged 17-34 years were 351 people or 25.0% and respondents aged over or equal to 35 years were 203 people or 14.5%.

In this age category, the results show that most women with the preeclampsia were aged 17-34 years. These results were not in accordance with studies that were carried out in various countries, which reported that maternal age at high risk for preeclampsia is the older or equal to 35 years old because this age is more likely to develop atherosclerosis, which affects small arteries, such as those in the kidneys and uterus, and causes hypertension[7,8]. Because of this, older pregnant women can easily develop preeclampsia. Maternal age may correlate with aging of the placenta. Duckitt reported an almost 2-fold increased risk of preeclampsia in pregnant women aged 40 years or more. The difference in results obtained can be due to the age distribution of the population, which is different for each country. However with the theories that support the occurrence of preeclampsia, it is still important to be vigilant and conduct strict screening of risk factors that exist in each pregnant woman[9,10].

Characteristics of respondents based on parity

It resulted that from a total of 2887 respondents, the number of respondents included in the primigravida category were 845 people or 29.3% and respondents belonging to the multigravida category were 2042 people or 70.7%. From total number of the respondents, those who were diagnosed with preeclampsia as many as 1195 respondents, whereas the primigravida was counted to be 344 respondents (28.79%) and multigravida as many as 851 (71.21%).

According to season with each parity category, it can be seen that number of labor for primigravida is obtained more in the rainy season, which is as much as 53.48% of the number of deliveries in primigravida in both years. For multigravida deliveries also found more in the rainy season (53.23%) than the number of deliveries in multigravida in 2017-2018. To see the relationship between season and parity in the two years, a cross-test with Chi-Square was carried out and the result showed p = 0.936. This figure explains that there was no significant difference between primiparous and multiparous patients with preeclampsia during dry and rainy seasons.

Table 2: The relationship between season and parity in 2017 and 2018

Parity	PE	Season				Total		p
		Rainy		Dry				
Primigravida	Yes	184	53.48%	160	46.52%	344	28.79%	0.936*
Multigravida	Yes	453	53.23%	398	46.77%	851	71.21%	
Total		637	53.31%	558	46.69%	1195	100.0%	

*Chi-Square test

Preeclampsia generally occurs in the first pregnancy, so a history of previous normal pregnancy is associated with a decrease in the frequency of preeclampsia. Therefore, nulliparity is a significant risk factor for preeclampsia. The relative risk (RR) of preeclampsia among women with nulliparity is reported to be 2.1 (95% CI, 1.9-2.4)[11]. Based on the season and parity relationship tests conducted in this study, there were no significant results. Pregnant women with preeclampsia are also mostly classified as multigravida parity. This might occur due to the limitation factor of this study itself, which was not enough data available about other risk factors for preeclampsia associated with parity, such as primipaternity, which is the impact of partner turnover on the incidence of preeclampsia in multiparity[12,13].

Distribution of preeclampsia per month

The distribution of the number of cases of preeclampsia per month each year in this study as well as in the two years can be seen in figures 1, 2 and 3. The highest number of cases of preeclampsia per month in 2017 (Figure 1) were obtained in August and October, with 4 cases each, or 14% of the total number of deliveries in that year. In accordance with Indonesian Meteorology, Climatology, and Geophysical Agency (BMKG) operational definition, for the 2017 season zone, August was included in the dry season and October was in the rainy season.

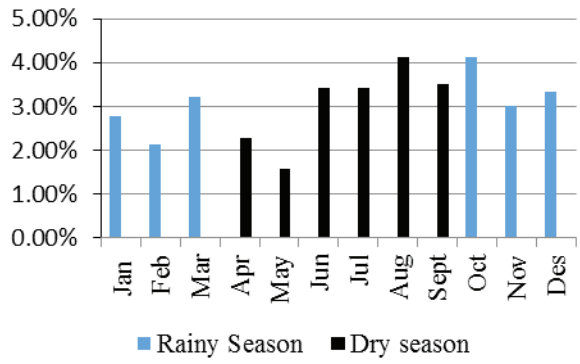


Figure 1: Chart of the number of preeclampsia per month in 2017

Similar to the data obtained in 2018 (Figure 2), incidence of preeclampsia was also obtained in September and October (respectively 4.65%), with being included in the dry season and October the rainy season. As explained previously, there is no difference in the incidence of preeclampsia between the two seasons because Indonesia is a tropical country, so differences such as humidity and temperature are not too significant[14].

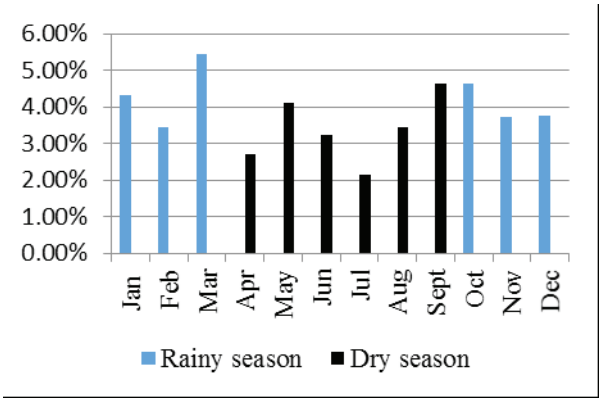


Figure 2: Chart of the number of preeclampsia per month in 2018

Based on the number of cases of preeclampsia in 2017-2018 (Figure 4), the highest incidence of preeclampsia was found in October, which was 10.63% of the total number of women with preeclampsia in both years. As has been explained above, according to BMKG's operational definition, October is included in the rainy season[15]. It was also found that March (the rainy season) is the second month with the most cases of preeclampsia. From these two data, it can be concluded that the distribution of the most prevalence of preeclampsia in Dr. Soetomo Teaching Hospital Surabaya for the period of 2017 - 2018 was mostly obtained in the rainy season and at least in April (dry season).

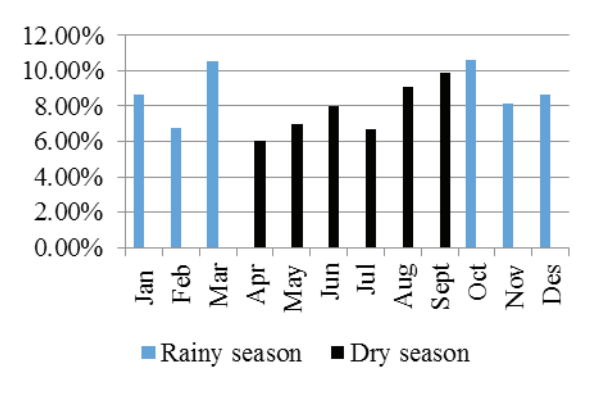
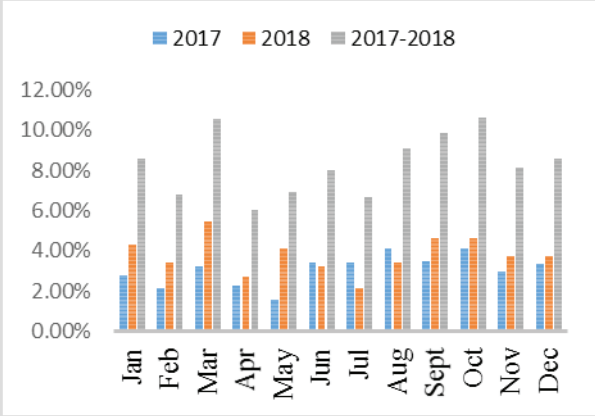


Figure 3: Chart of the number of preeclampsia per month in 2017-2018

These results are in agreement with some researchers who argue that low temperatures cause vasospasm which is part of the pathogenesis of preeclampsia. This is analogous to cold air which causes ischemia

which is strongly associated with the incidence of myocardial infarction; preeclampsia is thought to have a predisposing factor (cold air)[14]. Elongi et al. (2011) also found that preeclampsia might occur due to vasoconstriction, because the incidence increased during months with lower temperatures. Subramaniam (2007) further proposed that dehydration protects the brain from seizures that are usually experienced with eclampsia and that warmer temperatures result in increased fluid loss[9].

Figure 4: Comparison of the number of preeclampsia per month in 2017-2018



Further research is needed to examine more extensive cases of preeclampsia (preeclampsia, severe preeclampsia, chronic hypertension, superimposed severe preeclampsia and eclampsia), especially regarding other risk factors that can affect the prevalence of preeclampsia when associated with or not associated with seasons. This study does not display data on other preeclampsia risk factors, for example primipaternity factor; whether a woman's pregnancy with preeclampsia is a single or twin pregnancy; whether or not pregnant women with preeclampsia are patients who routinely perform antenatal care at Dr. Soetomo Teaching Hospital Surabaya; the patient's residence in which by knowing the patient's residence, information is obtained about how the humidity or the estimated temperature of the region might affect the prevalence preeclampsia when related to seasonal factors; and other risk factors that can affect the validity of the results of this study[16,17].

These other risk factors might be considered as exclusion criteria if the researcher really wants to know the depth or extension of the influence of the season on the incidence of preeclampsia, or as a multivariate analysis to determine the characteristics that influence the incidence of preeclampsia in this particular season in Indonesia, especially the city of Surabaya. The authors also suggest adding data on the highest rainfall in the year according to BMKG to find out the number of preeclampsia cases in the months with the highest rainfall, whether it increases or remains, and can be related to the results of cross-tests between seasons and preeclampsia[18,19]. Because of the limitations of this study, the authors call for further research to discuss the characteristics of other risk factors for preeclampsia in order to find out more about the things that influence the occurrence of preeclampsia, especially in patients of Dr. Soetomo Teaching Hospital Surabaya. By doing this, future research is expected to be able to produce data that can be useful in the prevention and better management of preeclampsia in each season in Indonesia, so that maternal and infant morbidity and mortality rate can be reduced.

Conclusion

From the data that has been collected and processed, it can be concluded that there was no significant correlation between seasons and the incidence of preeclampsia (preeclampsia, severe preeclampsia, chronic hypertension superimposed severe preeclampsia and eclampsia) in labor cases in Dr. Soetomo Teaching Hospital Surabaya for the period of 2017 - 2018.

Conflict of Interest: None

Source of Funding: This is a self-funding researc

Ethical Clearance: Taken from Health Research Ethics Committee of Dr. Soetomo Teaching Hospital Surabaya with number 1969/KEPK/IV/2020.

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