Research Article

Maternal and Perinatal Outcomes in Pregnancy Complicated with Pre- and Gestational Diabetes Mellitus

Hasil Maternal dan Perinatal pada Kehamilan dengan Komplikasi Diabetes Melitus Pra dan Gestasional

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Abstract

Objective: To analyze maternal and perinatal outcomes in pregnancies complicated by pre-gestational and gestational diabetes.

Methods: This is an analytical observational study with a cross-sectional design. We examined 57 women, 39 of pre-gestational diabetes mellitus (PGDM) women, and 19 had gestational diabetes mellitus (GDM). The data were analyzed using the chi-square and Fisher's exact test.

Results: There were no maternal deaths in either group. Pre-eclampsia was significantly higher in the PGDM group. Perinatal deaths and asphyxia were the same in both groups. Prematurity was higher in the PGDM group. Neonates of GDM women appeared to be heavier. Intrauterine fetal death (IUFD) rates were higher in the GDM group. Congenital anomalies were found in the GDM group.

Conclusion: There were differences in maternal and perinatal outcomes in both groups, namely pre-eclampsia and congenital anomaly.

Keywords: complication, congenital anomaly, diabetes mellitus gestational, pre-eclampsia.

Abstrak

Tujuan: *Untuk menganalisis hasil ibu dan perinatal pada kehamilan dengan komplikasi diabetes pra-kehamilan dan kehamilan.*

Metode: *Penelitian ini merupakan penelitian observasional analitik dengan desain potong lintang. Kami memeriksa 57 perempuan, 39 perempuan diabetes mellitus pra-kehamilan (PGDM), dan 19 memiliki diabetes melitus gestasional (GDM). Data dianalisis menggunakan uji chi-square dan Fisher's exact.*

Hasil: *Tidak ada kematian ibu pada kedua kelompok. Pre-eklamsia secara signifikan lebih tinggi pada kelompok PGDM. Kematian perinatal dan asfiksia sama pada kedua kelompok. Prematuritas lebih tinggi pada kelompok PGDM. Neonatus perempuan GDM tampak lebih berat. Angka kematian janin intrauterin (IUFD) lebih tinggi pada kelompok GDM. Anomali kongenital ditemukan pada kelompok GDM.*

Kesimpulan: *Terdapat perbedaan luaran maternal dan perinatal pada kedua kelompok yaitu preeklamsia dan kelainan kongenital.*

Kata kunci: *diabetes mellitus, gestasional, komplikasi, kelainan kongenital, preeklamsia.*

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INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disorder caused by either inadequate insulin production by the pancreas, insufficient insulin usage, or both.[1,2] Diabetes diagnosed before pregnancy, defined as pre-gestational diabetes mellitus (PGDM), is either DM-type-1 or DM-type-2.[3] Gestational diabetes mellitus (GDM) is a common metabolic complication in pregnancy, and glucose intolerance occurs in the second or third trimester.[3,4]

In 2019, International Diabetes Federation reported that 1 out of 6 birth is affected by hyperglycemic pregnancy, and 84% of which is GDM. Southeast Asia has become the first region with the highest prevalence of GDM, 27%, followed by North America and the Caribbean, with 20.8%, and Europe, with 16.3%. Based on a 2013 study from The Society of Indonesian Endocrinology, Indonesia has a 1.9–3.6% prevalence of GDM.[5]

Diabetic pregnancy is closely related to pregnancy and labor complications in both mother and baby. Mothers with PGDM are associated with complication risks such as macrosomia, neonate asphyxia, preterm labor, congenital anomaly, and stillbirth. Those complications can also appear in women with GDM but are less frequent and less severe due to onset differences of hyperglycemic conditions.[6,7]

There has been an increase in diabetic pregnancy cases globally. This study analyzed maternal and perinatal outcomes of PGDM and GDM pregnancies at Dr. Kariadi Hospital Semarang Indonesia by examining its short and long-term consequences for mothers or their offspring. This paper focuses on the different maternal and perinatal outcomes in pregnancies with PGDM and GDM, notably in Semarang, Indonesia. Even though many researchers had studied this topic, this paper shows findings that were slightly different from most hypotheses. Therefore, it contributes to existing literature and merits further discussion.

METHODS

This is an observational analytic study with a cross-sectional design to analyze the differences in maternal and perinatal outcomes of PGDM and GDM pregnancies in Dr. Kariadi Hospital Semarang. This study's subjects are mothers with PGDM and GDM pregnancies who gave birth in Dr. Kariadi Hospital Semarang in 2015–2019. The secondary data came from their medical records. The Health Research Ethics Committee Faculty of Medicine Diponegoro University/Dr. Kariadi Hospital Semarang granted ethical approval of the study before it began (176/EC/KEPK/FK-UNDIP/VII/2020).

This study used the consecutive sampling method to collect medical records of obstetric patients at Dr. Kariadi Hospital Semarang who met the inclusion and exclusion criteria. Inclusion criteria were medical records of mothers with PGDM and GDM pregnancies who gave birth at Dr. Kariadi Hospital Semarang. Exclusion criteria in this study were medical records that were illegible, incomplete, or damaged.

Data obtained were then analyzed using the Statistical Product and Service Solution program, which includes univariate analysis to determine the frequency distribution of variables. Later, bivariate analysis was conducted to see the differences of maternal and perinatal outcomes in PGDM and GDM pregnancies using the chi-square test or Fisher's exact test as an alternative. The difference was considered significant if the p-value is <0.05.

RESULTS

The study began with 95 subjects, and 57 met the inclusion criteria. We divided the subjects into two groups, 38 in the PGDM group and 19 in the GDM group. Based on the medical record database, there were 95 pregnancies complicated with DM in 2015–2019. The incidence of PGDM and GDM generally increased every year, but GDM had a greater increase (Figure 1).

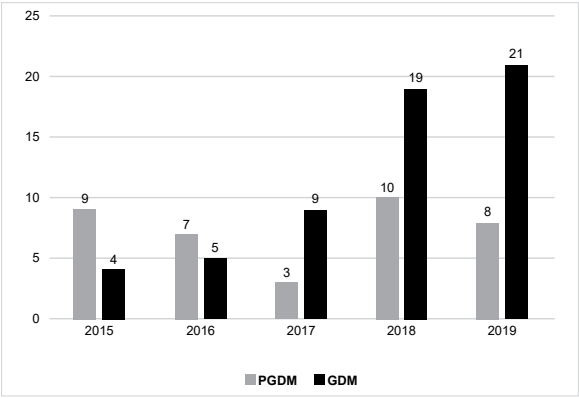

Figure 1. Subject Distribution at Dr. Kariadi Hospital Semarang in 2015–2019

Most patients had PGDM, which comprised 66.7% of the total sample, and 33.3% had GDM. Table 1 shows the subjects' characteristics and compares the two groups. Compared to the GDM group, the PGDM group had more mothers aged >35 years (52.6% vs. 10.5%; p < 0.05). Most of the pregnancies complicated by PGDM occurred in multiparous mothers (42.1%). Primiparous mothers had more cases of complications from GDM (47.4%) (p > 0.05). The study also shows that both PGDM and GDM mothers tend to deliver their babies by C-section, where GDM mothers were more frequent (p > 0.05). Comorbidities such as hypertension and obesity were common in both groups (p > 0.05). As in drug of choice, insulin appeared to be the most used regimen in both groups, and PGDM mothers tended to use insulin more than GDM mothers (92.1% vs. 57.9%; p < 0.05). Babies born from PGDM mothers tend to have low birth weight (57.9%), preterm (63.2%), and APGAR scores of 7–10 (63.2%). However, in the GDM group, babies born tend to have normal birth weight (47.4%), preterm (68.4%), and APGAR score of 7–10 (68.4%) (p > 0.05).

Table 1. Comparison Demographic Data of Pre-Gestational Versus Gestational Diabetes Groups

Variable	PGDM (38)		GDM (19)		*P-value*
	n	%	n	%	
Age (years)					
20–35	18	47.4	17	89.5	0.002¥*
>35	20	52.6	2	10.5	
Parity					
Nulliparous	10	26.3	5	26.3	0.424¥
Primiparous	12	31.6	9	47.4	
Multiparous	16	42.1	5	26.3	
Delivery method					
Vaginal	12	31.6	3	15.8	0.202¥
CS	26	68.4	16	84.2	
Blood pressure					
Normal	13	34.2	7	36.8	0.844¥
Hypertension	25	65.8	12	63.2	
BMI					
Normal	4	10.5	0	0	0.315¥
Overweight	9	23.7	6	31.6	
Obese	25	65.8	13	68.4	
Anti-diabetic drugs					
Insulin	35	92.1	11	57.9	0.004£*
Non insulin	3	7.9	8	42.1	
Childbirth weight					
LBW	22	57.9	7	36.8	0.298¥
Normal	13	34.2	9	47.4	
HBW	3	7.9	3	15.8	
Gestational age					
Preterm	25	65.8	12	63.2	0.844¥
Aterm	13	34.2	7	36.8	
APGAR score					
0–3	8	21.1	4	21.1	0.859¥
4–6	6	15.8	2	10.5	
7–10	24	63.2	13	68.4	

* Significant (p < 0.05); ¥ Pearson chi-square; £ Fisher's exact.

There was no maternal mortality either in PGDM or GDM groups found (Table 2). Pre-eclampsia was more frequent in PGDM mothers than GDM mothers (65.7% vs. 36.8%; p < 0.05). A total of 12 cases of perinatal death were found in which both groups had the same incidence (21%; p > 0.05). Preterm birth was the most common perinatal outcome in both groups, in which babies from PGDM mothers were more likely to be preterm compared to the ones from GDM mothers (65.8% vs. 63.2%; p > 0.05). Six macrosomic babies were born, mostly in the GDM group rather than the PGDM (15.8% vs. 7.9%; p > 0.05). Babies with mild asphyxia were more common in the GDM group, whereas babies with moderate asphyxia were more common in the PGDM group (p > 0.05). Ten out of twelve perinatal deaths caused by IUFD were more common in the GDM group (21.1 vs. 15.8%; p > 0.05). Three babies born with congenital anomalies were in the GDM

group (15.8%; p < 0.05). The analysis showed that the only significant differences in maternal and perinatal outcomes were pre-eclampsia and congenital anomalies (p < 0.05).

Table 2. Comparison Maternal and Perinatal Outcome Data of Pre-Gestational Versus Gestational Diabetes Groups

Variable	PGDM (38)		GDM (19)		*P-value*
	n	%	n	%	
Maternal outcome					
Maternal death	0	0	0	0	–
Pre-eclampsia	25	65.7	7	36.8	0.038¥**
Perinatal outcome					
Perinatal death	8	21.1	4	21.1	0.625£
Premature	25	65.8	12	63.2	0.844¥
Macrosomia	3	7.9	3	15.8	0.313£
Asphyxia					0.918£
Mild	3	7.9	2	10.5	
Moderate	5	13.2	2	10.5	
Severe	0	0	0	0	
IUFD	6	15.8	4	21.1	0.440£
Congenital anomaly	0	0	3	15.8	0.033£*

* Significant (p < 0.05); ¥ Pearson chi-square; £ Fisher's exact.

DISCUSSION

In this study, there was no maternal mortality in either group. In line with Alex Fong et al.'s findings, pre-eclampsia occurred more in the PGDM group than in the GDM group. This occurrence could be because of the prolonged exposure to hyperglycemia in the fetus in the PGDM group.[8,9] Pre-eclampsia pathology remains a complex and elusive matter, but studies show that in patients with DM and increased insulin resistance can increase the incidence of hypertension in these patients. Also, it seems that diabetic pregnancy is associated with dysfunction and vascular disease, which is one of the basic pathophysiologies of pre-eclampsia.[10,11]

Perinatal outcomes, including perinatal mortality, prematurity, macrosomia, asphyxia, and IUFD in pregnancies with PGDM and GDM, were not statistically significant. Similar to a study conducted in Sri Lanka, prematurity was more frequent in the PGDM group than in the GDM group, which was not statistically significant.[12] Another study found that preterm birth incidence increased 4-fold in mothers with diabetes and concluded they had poor glycemic control in the second trimester -2 is a risk factor for preterm labor, although there is no further explanation for this association. With various complications that occur, the health of the mother and baby is the most important thing, and early delivery can be a parameter in life management.[13]

In contrast to previous studies, in this study, macrosomia was more common in the GDM group. Meanwhile, Wahabi et al. reported that macrosomia incidence was more common in the PGDM group than in the GDM group.[14] The difference in onset of diabetes in mothers can result in differences in perinatal outcomes where theory stated that the PGDM group has a higher risk for macrosomia than GDM. However, this study who reported more frequent macrosomia in the GDM group than in the PGDM.[12] Judging from the study sample distribution, the incidence of obesity was more common in the GDM group than PGDM, where obesity was associated with a 4–12-fold increase in the likelihood of macrosomia and influenced the study results.[15–17]

Asphyxia had the same frequency in both groups, namely 21.1%. This finding contradicts previous studies where neonatal asphyxia was more common in the PGDM and GDM groups (24% vs. 8%).[9] This will affect the fetus who was born in the form of neonatal asphyxia.[18] The relatively high incidence of asphyxia in the GDM group could be related to the high incidence of macrosomia in the GDM group.

The incidence of perinatal mortality in this study was the same in both groups, namely 21.1%. Of the 12 causes of perinatal death, 10 were caused by IUFD and 2 by a stillbirth. IUFD cases were more common in the GDM group than in the PGDM group. This finding does not support where the incidence of IUFD was more prevalent in the PGDM group than in GDM.[9]

The exact cause of perinatal death is not fully explained. However, maternal factors such as pre-eclampsia, which is associated with diabetes, may also disturb the placental blood flow and fetal oxygenation resulting in IUFD. Also, the most common cause of IUFD in pregnancies with diabetes is a congenital anomaly. In this study, all congenital anomaly cases occurred in pregnancies with GDM.[19,20]

CONCLUSIONS

There are differences in maternal and perinatal outcomes between pregnancies with PGDM and GDM: pre-eclampsia and congenital malformation. This study revealed several maternal and perinatal events in accordance with the hypothesis, but there were several differences. Suggestions for future researchers are further research on the differences in maternal and perinatal outcomes in pregnancies with PGDM and GDM with other outcomes and research on findings that were not following the hypothesis. Also, there is a need for research on the postpartum outcomes of diabetic pregnancies.

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