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Original Research Article

Comparision of Incidence of Pregnancy Induced Hypertension in Pregnancy with Impaired Glucose Tolerance Vs Normal Glucose Tolerance

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Conflict of interest: Nil

Abstract

Objective: To find out what is the incidence and risk factors of pregnancy induced hypertension in patients with gestational diabetes mellitus.

Methods: It was a prospective observational and analytical study of 200 patients according to inclusion and exclusion criteria. All patients were informed about the study and written consent was taken .Proper history and clinical details, antenatal risk factors were considered. All the patients enrolled in the study were subjected to GDM screening at 24-28 weeks and then depending upon the GDM screening they were divided as case and control group. They were followed upto the time of delivery.

Results: There was increase in incidence of PIH with advance maternal age and higher BMI,. Higher incidence of PIH was found in primigravida . Most of the patients who developed PIH had HBA1C between 4.8-5.7% i.e 61.53% and 53.84% in GGI and GDM group respectively. In GGI, 92.30% and in GDM 76.92%,who developed PIH had first trimester FBS concentration <92 mg/dl, so in the present study correlation between FBS concentration with development of PIH could not be established. Most of the patients who developed PIH had underwent caesarean delivery, 84.61% in both groups, suggesting increase likelihood of caesarean delivery with development of PIH

Conclusion: By doing early detection and giving proper management with strict glycemic control we can decrease the incidence of preeclampsia. Regular and more frequent blood pressure monitoring is required in gestational diabetes pregnant women, so there by we can decrease the maternal morbidity and mortality.

Keywords: GGI(Gestational Glucose Intolerance) ,GDM(Gestational Diabetes Mellitus),FBS (Fasting Blood Sugar),PIH(Pregnancy Induced Hypertention),

Introduction

Preeclampsia is the cause of significant maternal and fetal mortality and morbidity. It is characterized by new-onset hypertension and proteinuria after 20 weeks of gestation. Preeclamptic women and children born from preeclamptic pregnancies are at greater risk to develop severe cardiovascular complications and metabolic syndromes later in life. The incidence of preeclampsia is estimated to be seven times higher in developing countries as compared to the developed countries. Hypertensive disorders affect as many as 10% of all pregnancies worldwide. GDM affects 3-25% of pregnancies. Hypertensive disorders features among the top 6 causes of maternal mortality and are responsible for nearly 10% of all maternal deaths. Globally the median estimates of GDM range from 6 to 13%. [1,2]

Little is known about the burden of diabetes mellitus (DM) in pregnancy in low- and middle-income countries despite high prevalence and mortality rates being observed in these countries. Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance occurring or detected for the first time during pregnancy .The global prevalence of GDM has been increasing, likely because of the increase in maternal obesity, delayed child bearing and sedentary lifestyle. More prevalent in urban areas than in rural areas. The prevalence of GDM in India varies from 3.8 to 21% in different parts of the country.[3]

Hypertensive disorders are more common in women with GDM than in normoglycaemic controls of similar age, parity and BMI. It has been hypothesized that this association, at least in part, could be due to insulin resistance, which is a physiologic phenomenon and adaptation in normal pregnancy but that in the predisposed individual with other risk factors could lead to pathologic procedures for instance the development of PIH, GDM, or both. Correlation does not necessarily imply causation, but the development of possible preventive strategies and therapeutic interventions based on this data could be beneficial.[4,5]

Materials and methods

Study Area – Study was carried out in department of obstetrics and gynecology of the Holy family hospital. It has well equipped obstetrics and gynaecology department with efficient and inspiring staff. The obstetrics OPD boasts of 18,000 – 20,000 patients annually. It is an important referral centre.

Study Design-Prospective observational and analytical study in all antenatal women who are seen and booked in Holy Family Hospital.

Study Period – August 2018- June 2019
Duration of study: 11 months

Sample Size – 200 patients according to our inclusion and exclusion criteria who are seen and booked in Holy Family Hospital will be enrolled in this study. All patients will be informed about the study and written consent will be taken before enrollement in the study. Proper history and clinical details will be taken with taking antenatal risk factors in account. In high risk cases,special investigations will also be sent.All the patients enrolled in the study will be subjected to GDM screening at 24-28 weeks and then depending upon the GDM screening they will be divided as case and control group. They will be followed upto the time of delivery. The case and control group will be further divided depending upon development of hypertensive disorders.

Inclusion criteria:

- All antenatal women who are seen and booked in Holy Family Hospital
- Singleton pregnancy

Exclusion criteria:

1. Thrombotic disorder
2. Chronic inflammatory disease

3. Overt type 2 diabetes mellitus
4. Type1 diabetes mellitus
5. Multiple gestation
6. Chronic liver disease
7. Essential hypertension
8. IVF pregnancy

Time of screening/testing Universal screening should be performed between 24-28weeks of pregnancy.This is the stage at which shift in carbohydrate metabolism occurs.It is late enough to allow for the developing intolerance but early enough to allow timely efficacious interventions. But in high risk cases this screening should be performed earlier.

Screening: targeted or universal Universal screening for GDM is essential as it is generally accepted that women of Asian origin and especially ethnic Indians are at higher risk of developing GDM & subsequent type-2 DM. This study has used DIPSI criteria to screen all patients for GDM.

Observations

Table 1: Development of preeclampsia in GGI/GDM group, age wise distribution

	GGI (43)		GDM (57)			
Age	**Normotensive**	**HTN**	**Normotensive**	**HTN**	**Frequency**	**P value**
<19YRS	0	0	0	0	0	>0.05
20-24YRS	5 (11.62%)	1 (2.32%)	4 (7.01%)	2 (3.50%)	12%	
25-29YRS	11 (25.28%)	5 (11.62%)	17 (29.82%)	5 (8.77%)	38%	
30-34YRS	12 (27.90%)	7 (16.27%)	20 (35.08%)	4 (7.01%)	43%	
35-39YRS	2 (4.65%)	0	3 (5.26%)	2 (3.50%)	7%	
>40YRS	0	0	0	0	0	
TOTAL	30	13	44	13	100%	

Table 2 : Development of preeclampsia in normoglycemic (control group) age wise distribution

AGE	**Normotensive (81)**	**PIH (19)**	**Frequency**	**P value**
<19YRS	1 (1.23%)	0	1%	>0.05
20-24YRS	16 (19.75%)	4 (21.05%)	20%	
25-29YRS	40 (49.38%)	5 (26.31%)	45%	
30-34YRS	23 (28.39%)	8 (42.10%)	31%	
35-39YRS	1 (1.23%)	2 (10.52%)	3%	
>40YRS	0	0	0	
TOTAL	81	19	100%	

Table 3: Development of preeclampsia in GGI/GDM group, parity wise distribution

		GGI	GDM		Frequency	P value
NORMOTENSIVE		**HTN**	**Normotensive**	**HTN**		>0.05
PRIMI	15 (34.88%)	9 (20.93%)	20 (35.08%)	7 (12.28%)	51% (N=51)	
MULTI	15 (34.88%)	4 (9.30%)	24 (42.10%)	6 (10.52%)	49% (N=49)	
TOTAL	30	13	44	13	100%	

Table 4: Development of preeclampsia in normoglycemic (control group) parity wise distribution

	Normotensive	PIH	Frequency	P value
PRIMI	53 (65.43%)	9 (47.36%)	62 (62%)	0.08 (p>0.05)
MULTI	28 (34.56%)	10 (52.63%)	38 (38%)	
TOTAL	81	19	100 (100%)	

Table 5: Distribution Of Cases According To Bmi (In Case Group):

	GGI	GDM	Frequency
UNDERWEIGHT	1 (2.32%)	3 (5.26%)	4%
NORMAL	15 (34.88%)	24 (42.10%)	39%
OVERWEIGHT	20 (46.51%)	21 (36.84%)	41%
OBESE CLASS1	7 (16.27%)	9 (15.78%)	16%
OBESE CLASS2	0	0	0
OBESE CLASS3	0	0	0
TOTAL = 100	43	57	100%

Table 6: distribution of cases according to bmi (in control group)

	Normoglycemic	Frequency
UNDERWEIGHT	8	8%
NORMAL	50	50%
OVERWEIGHT	31	31%
OBESE CLASS1	9	9%
OBESE CLASS2	2	2%
OBESE CLASS3	0	0
TOTAL	100	100%

Table 7: Association between maternal FBS concentration and development of PIH in GGI and GDM

	GGI		GDM			
WHO Criteria	**Normotensive**	**HTN**	**Normotensive**	**HTN**	**Frequency**	**P Value**
FBS <92mg/dl	21	12 (92.30%)	34	10 (76.92%)	77 (77%)	0.28
FBS ≥92mg/dl	9	1 (7.69%)	10	3 (23.07%)	23 (23%)	
TOTAL = 100	30	13	44	13	100 %	

Table 8: Association between maternal FBS concentration and development of PIH in normoglycemics

WHO Criteria	Normotensive	PIH	Frequency	P value
FBS <92mg/dl	70	14 (73.68%)	84 (84%)	p>0.05
FBS ≥92mg/dl	11	5 (26.31%)	16 (16%)	
TOTAL	81	19	100 (100%)	

Table 9: Associate between maternal HBA1c value and development of PIH in GGI and GDM

	GGI		GDM			
HBA1C	**NORMO TENSIVE**	**HTN**	**NORMOT ENSIVE**	**HTN**	**FREQUENC Y**	**P value**
<4.8%	6	5 (38.46%)	15	3 (23.07%)	29 (29%)	p>0.05
4.8-5.7%	23	8 (61.53%)	24	7 (53.84%)	62 (62%)	
>5.7%	1	0	5	3 (23.07%)	9 (9%)	
TOTAL = 100	30	13	44	13	100 %	

Table 10: Associate between maternal HBA1c concentration and development of PIH in normoglycemics

HBA1C	NORMOTENSIVE	PIH	FREQUENCY	P value
<4.8%	42	6 (31.57%)	48 (48%)	p>0.05
4.8-5.7%	38	13 (68.42%)	51 (51%)	
>5.7%	1	0	1(1%)	
TOTAL=100	81	19	100 %	

Table 11: Risk of pregnancy induced htn associated with GDM

	Incidence In normoglycemic	Incidence in GGI (43)	Incidence in GDM (57)	OOD'S ratio	CI	P value
1. Normotensive	74 (74%)	30 (30%)	44 (44%)	1.50	0.77-2.93	0.00001
2. PIH	26 (26%)	13 (13%)	13 (13%)			
TOTAL=200	100 (100%)	100 (100%)				

Table 12: overall obstetrical and neonatal outcome in both case & control groups

	Control			case				
				GGI		GDM		
		Normotensive	PIH	Normotensive	HTN	Normotensive	HTN	P Value
1	**MEAN GESTATION AGE AT TIME OF DELIVERY**							
	<36W6DAYS	7	4	3	5	5	4	0.001 P<0.05
	≥37WEEKS	81	11	30	13	44	13	
2.	**MODE OF DELIVERY**							
	NORMAL	49	8	19	2	25	2	P 0.0004
	INSTRUMENTAL	0	0	0	0	0	0	
	LSCS	32	11	11	11	19	11	
3.	**MEAN BIRTH WEIGHT**							
	SGA	5	0	0	2	2	3	0.837 P>0.05
	AGA	76	8	30	10	42	10	
	LGA	0	0	0	1	0	0	
4.	**APGAR <7 AT 5MIN**	1	2	0	0	1	1	0.29 i.e p>0.05
5.	**NEONATAL COMPLICATIONS**							
	1.RESPIRATORY DISTRESS	13	3	2	0	7	2	p>0.05
	2.IUGR	9	4	0	1	3	**2**	
	3.NNJ	5	1	3	1	4	**2**	
	4.TTNB	3	1	0	1	1	2	
	5.OTHERS	6	0	6	4	22	56	

Results

1. In the present study, 200 patients (100 cases and 100 controls) according to our inclusion and exclusion criteria,

2. who are seen and booked in Holy Family Hospital were enrolled.
3. All the patients were subjected to GDM screening at 24-28 weeks and then depending upon the results, they were divided as case and control group. They were followed till the time of delivery, for development of PIH and further divided accordingly-

CASE A) GGI (Gestational glucose intolerance)

(n=100) B) GGI with PIH (Gestational glucose intolerance with PIH)

C) GDM (Gestational diabetes mellitus)

D) GDM with PIH (Gestational diabetes mellitus with PIH)

Control

(n=100) A) Normoglycemic-normotensive B) Normoglycemic hypertensive

3 In GGI and GDM group,most of the patients were in age group 30-34 years i.e 44.18% and 42.10% respectively.In GGI group, 53.58% who developed PIH were in age group 30-34yrs .In GDM group,38.46% who developed with PIH were in age group 25-29yrs ,suggesting increase in incidence of PIH with advance maternal age.

4 51% were primigravida and 49 % were multigravida. Higher incidence of PIH was found in primigravida with 20.93% and 12.28% in GGI and GDM group respectively.

5 Increase in the incidence of PIH was found in women with higher BMI, 61.53% and 46.15% in GGI and GDM group who developed PIH respectively were overweight.

6 In GGI, 92.30% and in GDM 76.92%,who developed PIH had first trimester FBS concentration <92 mg/dl, so in the present study correlation between FBS concentration with development of PIH could not be established.

7 Most of the patients who developed PIH had HBA1C between 4.8-5.7% i.e 61.53% and 53.84% in GGI and GDM group respectively.

8 In our study, maximum number of patients in GGI and GDM group who developed PIH had delivery at period of gestation 37-39w6d i.e 61.53% and 76.92% respectively due to close fetomaternal survillence and good antenatal care.

9 Most of the patients who developed PIH had underwent caesarean delivery, 84.61% in both groups, suggesting increase likelihood of caesarean delivery with development of PIH.

10 In the present study, incidence of PIH was found 26% in cases and 19% in control.Positive correlation was found between GGI,GDM and development of pregnancy induced hypertension since the odd's ratio is 1.5 (significant) and p value is <0.05 (i.e 0.00001).

Statistical analysis:

The collected data was summarized by using frequency, percentage, mean & S.D. To compare the qualitative outcome measures Chi-square test or Fisher's exact test was used. To compare the quantitative outcome measures independent t test was used. If data was not following normal distribution, Mann Whitney U test was used. SPSS version 22 software was used to analyse the collected data. p value of <0.05 was considered to be statistically significant.

Discussion

The present study is prospective observational and analytical study conducted in holy family hospital in all antenatal women (200) who are seen and booked in Holy Family Hospital. All patients were subjected to GDM screening at

24-28weeks of gestation using DIPSI criteria and accordingly they were further divided into case and control. Both hypertension and diabetes have detrimental effects on pregnant population. The purpose of this study was to find out incidence of preeclampsia in gestational diabetic mothers and its maternal and neonatal outcome**.**

Malik A et al studied disease biology and burden, its management strategies with reference to India.This review summarizes the pathophysiology of preeclampsia, emerging new hypothesis of its origin, risk factors that make women susceptible to developing preeclampsia and the potential of various biomarkers being studied to predict preeclampsia. The health care of developing countries is continuously challenged by substantial burden of maternal and fetal mortality. India despite being a fast developing country, is still far behind in achieving the required maternal mortality rates as per Millennium Development Goals set by the World Health Organization. Further, this review discusses the prevalence of preeclampsia in India, health facilities to manage preeclampsia, current guidelines and protocols followed and government policies to combat this complication in Indian condition.[1]

Similar to previous study,Osungbade KO et al studied public health perspectives of preeclampsia in developing countries and implication for health system strengthening. The prevalence of preeclampsia in developing countries ranges from 1.8% to 16.7%. Many challenges exist in the prediction, prevention, and management of preeclampsia. Treatment remains prenatal care, timely diagnosis, proper management, and timely delivery. Prevailing household, community, and health system factors limiting effective control of preeclampsia in these countries were identified, and strategies to strengthen health systems were highlighted. Overcoming the prevailing challenges in the control of preeclampsia in developing countries hinges on the ability of health care systems to identify and manage women at high risk.[2]

King H studied epidemiology of glucose intolerance and gestational diabetes in women of childbearing age whereas Hossein-nezhad A et al did a systematic review on the burden of diabetes mellitus during pregnancy in low-and middle-income countries.A total of 45 articles were included. It was concluded that the existing published data are insufficient to build a clear picture of the burden and distribution of DM in pregnancy in low- and middle-income countries. Consensus on a common diagnostic criterion for GDM is needed. Type 1 and 2 DM in pregnancy and postpartum DM are other neglected areas.[3,4]

An update from India on gestational diabetes was given by Kayal A et al.They did comparison of incidence of pregnancy induced hypertension in gestational diabetes mellitus and healthy pregnant women.It was seen that women with GDM had a significant higher prevalence of PIH than matched controls The prevalence of pre-eclampsia and essential hypertension was also higher in women with GDM than matched controls but not significant.

Conclusion: Our results show that hypertensive disorders are more common in women with GDM than in normoglycaemic controls of similar age, parity and BMI. Vanlalhruaii SR et al prevalence of gestational diabetes mellitus and its correlation with blood pressure in Manipuri women. Using the ADA (2004) guideline, 1% of the total study population had GDM. The BP of these patients fell within the prehypertensive range, thus suggesting an association between GDM and BP.[5-7]

Wallace MK et al did a prospective longitudinal correlation study of behavioral and biological determinates of inflammation and the development of pregnancy-induced hypertension and gestational diabetes in pregnant women. Oren S et al also studied gestational diabetes mellitus and hypertension

in pregnancy and worked on hemodynamics and diurnal arterial pressure profile.The PIH women had significantly higher AP determinations throughout the 24 h, with no change in the diurnal variation, ie, nocturnal decline and early morning peaks. The LV mass was greater in PIH and GDM than in the normotensive women, despite normal AP in GDM. The increased LV mass in GDM was mainly due to LV dilatation and not to increased thickness of its walls. In PIH, the increase in AP was due to peripheral vasoconstriction, while cardiac output was preserved. The LV systolic functions did not differ among the three groups. However, a slight reduction in the myocardial contractility was found in PIH and GDM. The LV relaxation was significantly impaired in both PIH and GDM. Thus, GDM and PIH, although differing in their 24-h AP profile, are characterised by LV hypertrophy and reduction in diastolic function.[8,9]

Kayemba-Kay's S et al studied that maternal hyperinsulinism and glycaemic status in the first trimester of pregnancy are associated with the development of pregnancy-induced hypertension and gestational diabetes. It was a prospective study of pregnant women booking before 15th week of gestation. At the first antenatal visit, standard measures of height, weight, blood pressure (BP) and social status were recorded, and blood sample was drawn for measurements of fasting glucose and plasma insulin. Oral glucose tolerance test with 75 g glucose load was performed after overnight fast.At 12 weeks of gestation, women who became hypertensive were heavier ($P<0.001$), with higher BMI ($P<0.001$) than controls. Their data suggest that women who develop PIH may be metabolically challenged at early stages of pregnancy with hyperinsulinism, insulin insensitivity and slightly higher BP.[10]

Perveen S et al established relationship between gestational diabetes and pregnancy induced hypertension (PIH).Aim of this work was to review the most recent data available on PIH and GDM and find the association between both conditions during gestation. The main issue to solve is how to find the association between GDM and PIH. Very limited data and research studies are available, creating hindrance to find any association. The one way to find the association now, can be that it should be checked the level of hypertension before, during and after gestation. According to the available data and research, it could be deduced that insulin resistance, present in non-insulin dependent diabetes mellitus (NIDDM), may provide association more frequently. However, no direct evidential data is available for this link.[11]

Ogawa K et al studied association between birth weight and risk of pregnancy-induced hypertension and gestational diabetes in Japanese women.They used data from the Japan Public Health Center-based Prospective Study .Women were divided into five categories according to their birth weight, and the relationship between birth weight and risk of PIH and GDM was examined using multilevel logistic regression analyses with place of residence as a random effect. They observed an increased risk of PIH among women born with lower birth weight albeit non-significant increased risk of GDM among Japanese women.[12]

By doing Universal screening for detection of GDM from the first antenatal visit onwards, we can detect the cases early, by achieving good glycemic control. Whatever the underlying reason for the observed increases in prevalence of GDM, the health care system will require additional resources to provide care during pregnancy and reduce adverse perinatal outcome. Even though the Government of India formulating the guidelines for universal screening for GDM, due to economic and health system workload reasons, Universal Screening is not being implemented throughout the India, especially at the level of PHC'S and CHC'S results in about a third of GDM women going undetected thereby

causing increased maternal and fetal morbidity and mortality**. [9-13]**

Conclusion Strengthening the heath system: to meet the increasing demands of delivering diabetes and GDM related care, there is a critical need for incorporating the elements of prevention, surveillance, screening and management into all levels of health care (primary, secondary, tertiary). Improvement of the public health care system will help provide more equitable delivery of services that is likely to have a large impact on reducing the disease burden and preventing much of the maternal and fetal complications especially preeclampsia.

Declarations:

Funding: None

Availability of data and material: Department of Obstetrics and Gynecology of the Holy Family Hospital

Code availability: Not applicable

Consent to participate: Consent taken

Ethical Consideration: There are no ethical conflicts related to this study.

Consent for publication: Consent taken

What this study add to existing knowledge

Establishing referral and follow-up systems: given that diabetes and GDM require long term continued care, follow up processes, across different levels of the health care system, are essential to increase operative efficacy, optimize costs, timely treatment and follow up interventions. Providing patient education for enabling self-care and management: public health system constraints, due to shortage of resources, and providers, can be addressed to great extent by empowering community health workers, midwives, women self –help groups and patients and communities with necessary information on GDM and diabetes prevention that they can utilize for self-monitoring and self-care. This can facilitate achievement of improved health outcomes, reduced unnecessary hospital visits, contributing to considerable cost savings for the health system. By doing early detection and giving proper management with strict glycemic control we can decrease the incidence of preeclampsia. Regular and more frequent blood pressure monitoring is required in gestational diabetes pregnant women, so there by we can decrease the maternal morbidity and mortality.

Contribution by different authors

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