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Original Research Paper

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ASSOCIATION OF VITAMIN D DEFICIENCY WITH GESTATIONAL DIABETES MELLITUS AND ITS ADVERSE MATERNAL AND PERINATAL OUTCOMES

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ABSTRACT Vitamin with its active metabolite 1,25(oh)2cholecalciferol apart from its action on musculoskeletal system has many metabolic actions. Recently vitamin D has been identified as the modifiable risk factor for the development of gestational diabetes mellitus(GDM). It increases insulin secretion and insulin sensitivity in peripheries. This study was conducted in 200 antenatal women to study the incidence of GDM in women with suboptimal vitamin D levels and also to identify the risk of adverse maternal and fetal outcomes in women with GDM and vitamin D deficiency. Our study revealed that vitamin D deficient women are at increased risk of developing GDM during pregnancy. e also found that women with GDM and vitamin D deficiency are at increased risk of requiring induction, caesarean section.

KEYWORDS : Vitamin D, cholecalciferol, gestational diabetes mellitus.

INTRODUCTION

Vitamin D, its active metabolite being 1,25 hydroxy cholecalciferol is long known for its classical action on musculoskeletal system via its part in calcium metabolism along with parathyroid hormone. The non classical action of vitamin D is an area of increasing interest which includes immunomodulatory, anabolic, antiinfective and antitumoral[1]. Prevalence of vitamin D deficiency among Indian population is very high due to various factors like decreased sun exposure, complexion, genetic polymorphisms in enzymes involved in the formation of active metabolite of vitamin D - 1,25dihydroxycholecalciferol[2].

Various studies have shown association of vitamin D deficiency with gestational diabetes mellitus(GDM), preeclampsia, low birth weight, increased caesarean section rate and postpartum depression[3].

VITAMIN D AND GESTATIONAL DIABETES MELLITUS

Gestational diabetes mellitus is considered to be in an epidemic range in our country due to the genetic risk enhanced by environmental factors like sedentary life style, high calorie diet. Among the risk factors in Indian women that put them at risk of GDM, vitamin D deficiency is considered to be a modifiable risk factor. Vitamin D plays an important role in modifying the risk of diabetes.

Vitamin D being a nuclear hormone acts via modifying DNA transcription of its target proteins. Vitamin D promotes beta cell function. Beta cells of pancreas have receptors specific for 1,25dihydroxycholecalciferol which increases insulin secretion. Vitamin D could *also* affect insulin sensitivity. Vitamin D along with its receptor VDR activates the VDR-retinoic acid X receptor complex which binds to the vitamin D response elements in the promoter region of insulin receptor gene thereby increasing its expression[4].Thus 1,25(OH)2D has an effect on stimulating the expression of insulin receptors on insulin sensitive tissues namely adipose tissue and skeletal muscle which in turn will increase the insulin sensitivity.

OBJECTIVES

1. To study the prevalence of vitamin D deficiency in our population
2. To identify the incidence of gestational diabetes mellitus(GDM) in pregnant women with vitamin D deficiency and compare it with incidence of GDM in women with optimal vitamin D levels.
3. To compare the incidence of adverse maternal outcomes in women with GDM with vitamin D deficiency and without vitamin D deficiency.
4. To compare the incidence of adverse perinatal outcome in women with GDM with vitaminD deficiency and without vitamin D deficiency

METHODS AND METHODOLOGY

Type of study : Prospective analytical study.
Sample size : 200

Pregnant women in first trimester (gestational age<12 weeks) with intrauterine singleton pregnancy attending our outpatient clinic are invited to take part in the study. After getting informed consent to participate in the study complete history including history of GDM in previous pregnacy or features suggesting GDM in previous pregnancy like unexplained still birth, macrosomia is elicited.

EXCLUSION CRITERIA:

1. women with overt diabetes
2. women with history of GDM in previous pregnancy or features suggestive of GDM in previous pregnancy like unexplained IUD, macrosomia

Those included in the study are subjected to clinical examination including determination of BMI. Blood samples were taken from cubital vein in which levels of following parameters were studied.

1. Fasting blood sugar, post prandial blood sugar, HBA1C – to rule out undiagnosed overt diabetes mellitus
2. Vitamin D level

According to vitamin D level women were categorised into 3 groups
Optimal - >30ng/ml
Insufficient – 21 to 30ng/ml
Deficient - <20ng/ml
Based on Endocrine society classification.

Screening for GDM done by fasting blood sugar and Oral glucose challenge test at 24 to 28 weeks and at 36 weeks.

Diagnosis of GDM was made on the basis of DIPSI guidelines(2) and those diagnosed with GDM were given treatment according to our hospital protocol for GDM management.

Time of onset of delivery, mode of onset of delivery, mode of delivery, if by caesarean section, indication for caesarean were all noted. After birth 1 minute and 5 minute apgar score, birth weight, need for neonatal ICU admission were all noted. The results were tabulated and statistical significance was calculated using chi square test and pearson correlation coefficient.

RESULTS

TOTAL NO OF MOTHERS UNDERWENT STUDY=200

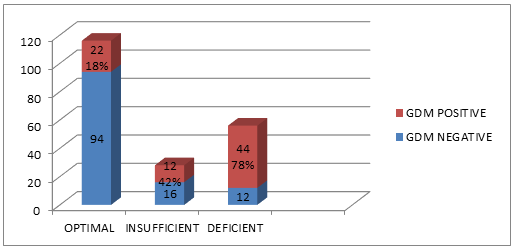
CATEGORY	PREVALENCE of vitamin D deficiency	PERCENTAGE
OPTIMAL	116	58%
INSUFFICIENT	28	14%
DEFICIENT	56	28%

COMPARING THE PREVALENCE of GESTATIONAL DIABETES MELLITUS IN DIFFERENT STAGES OF VITAMIN D DEFICIENCY

			GESTATIONAL DM		Total
			NO	YES	
ENDOCRINE SOCIETY VIT. D DEFICIENCY STAGES	0 - 20 DEFICIENT	Count	12	44	56
		% of Total	6.0%	22.0%	28.0%
	20 - 30 INSUFFICIENT	Count	16	12	28
		% of Total	8.0%	6.0%	14.0%
	30 AND ABOVE NORMAL	Count	94	22	116
		% of Total	47.0%	11.0%	58.0%
Total		Count	122	78	200
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	56.607a	2	.001
Likelihood Ratio	58.376	2	.001
N of Valid Cases	200		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.92.



GDM * MODE OF DELIVERY

Crosstab — Count

		MODE OF DELIVERY		Total
		CAESAREAN SECTION	NORMAL VAGINAL DELIVERY	
GDM	NO	36	86	122
	YES	37	41	78
Total		73	127	200

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.598[a]	1	.010		
Continuity Correction[b]	5.847	1	.016		
Likelihood Ratio	6.551	1	.010		
Fisher's Exact Test				.016	.008
Linear-by-Linear Association	6.565	1	.010		
N of Valid Cases	200				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 28.47.

b. Computed only for a 2x2 table

GDM * BIRTH WEIGHT

Crosstab — Count

		BIRTH WEIGHT			Total
		LOW	NORMAL	OVER WEIGHT	
GDM	NO	26	96	0	122
	YES	28	48	2	78
Total		54	144	2	200

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.821[a]	2	.012
Likelihood Ratio	9.397	2	.009
Linear-by-Linear Association	3.221	1	.073
N of Valid Cases	200		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is .78.

Crosstab — Count

		TERM OR PRETERM		Total
		PRE-TERM	TERM	
GDM	NO	28	94	122
	YES	20	58	78
Total		48	152	200

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.189[a]	1	.664		
Continuity Correction[b]	.070	1	.791		
Likelihood Ratio	.188	1	.665		
Fisher's Exact Test				.735	.393
Linear-by-Linear Association	.188	1	.665		

GDM * ONSET OF DELIVERY

Crosstab — Count

		ONSET OF DELIVERY		Total
		SPONTANEOUS	INDUCED	
GDM	NO	97	25	122
	YES	31	47	78
Total		128	72	200

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	32.654[a]	1	.000		
Continuity Correction[b]	30.951	1	.000		
Likelihood Ratio	32.798	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	32.491	1	.000		
N of Valid Cases	200				

GDM * APGAR SCORE

Crosstab — Count

		APGAR SCORE		Total
		LOW	NORMAL	
GDM	NO	6	116	122
	YES	15	63	78
Total		21	179	200

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	10.372[a]	1	.001		
Continuity Correction[b]	8.905	1	.003		
Likelihood Ratio	10.156	1	.001		
Fisher's Exact Test				.002	.002
Linear-by-Linear Association	10.320	1	.001		
N of Valid Cases	200				

DISCUSSION

Out of the 200 pregnant women who joined the study 84(42%) had vitamin D level below 30ng\ml. A previous study by study by harinarayanan et al 2 showed only 6% of south Indian women had vitamin D in optimal levels

Out of this 84 women with suboptimal vitamin D levels in the first trimester, 56 (66%) developed gestational diabetes mellitus during the antenatal period.

But only 22 women with normal Vitamin D levels developed gestational diabetes mellitus.

The difference in incidence of gestational diabetes mellitus in groups with optimal and suboptimal deficiency is statistically significant P value <0.001

The risk of developing gestational diabetes mellitus is dose dependent ie with increasing severity of vitamin D deficiency the risk of developing gestational diabetes mellitus increases. This is evident by looking at the increased incidence of gestational diabetes mellitus in women with vitamin D deficiency(44out of 56) than in women with vitamin D insufficiency (12 out of 28).

The incidence of spontaneous labour in women with vitamin D deficiency was lower than women with adequate vitamin D levels. The incidence of caesarean section in women with vitamin D deficiency with GDM was higher(P value <0.001) than in women

with GDM with optimal Vitamin D levels. This is consistent with the previous study by merewood et al5 comparing the primary caesarean section rate in women with vitamin D deficiency and with optimal vitamin D levels (28%vs14%). The indication for caesarean section included failed induction, cephalo pelvic disproportion, non progression of labour, malpresentation and fetal distress. Cervical Dystocia was the most common cause of caesarean section in women with vitamin D deficiency whereas fetal distress was the most common indication in women with normal vitamin D levels though the difference was not clinically significant.

In our study there was no clinically significant difference in the incidence of preterm delivery and low birth weight between the two groups (P value >0.005) Yet there was statistically significant difference between the apgar score between the two groups.

SUMMARY

Vitamin D deficiency is highly prevalent among our pregnant women. Women with vitamin D deficiency are at more risk of developing gestational diabetes mellitus during their pregnancy than the pregnant women with optimal vitamin D levels. Women with vitamin D deficiency with GDM are at more risk of requiring induction of labour. Caesarean section was more common among with vitamin d deficiency. Our study did not show significant difference in birth weight between two groups whereas low apgar score was more common in women with vitamin D deficiency.

CONCLUSION

Optimisation of vitamin D levels before pregnancy and routine vitamin D supplementation during pregnancy can reduce the incidence of GDM during pregnancy which is a disease of public health concern during pregnancy and there by reducing the adverse maternal and fetal outcomes associated with GDM . Government laid plans to fortify food items with vitamin D can reduce the incidence of vitamin D deficiency in the society decreasing the volume of women with vitamin D deficiency in the child bearing age group.

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