How to Cite:
Bhramaramba, C., Kumari Ghanta, S., Kumar, A. S., & Haritha, C. (2022). Prevalence of gestational diabetes mellitus along with maternal and fetal outcome in government maternity hospital, Tirupati. *International Journal of Health Sciences*, *6*(S6), 4481–4493. https://doi.org/10.53730/ijhs.v6nS6.10532

Prevalence of gestational diabetes mellitus along with maternal and fetal outcome in government maternity hospital, Tirupati

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Abstract---Background: Gestational diabetes mellitus (GDM) is a metabolic disorder defined as glucose intolerance with the onset or first recognition during pregnancy. Women with GDM are at increased risk for adverse obstetric and perinatal outcome. Aim: To find the prevalence of Gestational diabetes mellitus among antenatal women and to diagnose Gestational diabetes mellitus among antenatal women between 24-28 weeks gestational age by modified Glucose challenge test and to study maternal and fetal outcome. Materials and methods: A prospective and observational study conducted in the antenatal women between 24 to 28 weeks gestational age attending outpatient selected as study subjects. The number of cases included in the study was 2000. Results: All patients accepted the test readily and no adverse effects were observed. In the present study GCT positive in 58 cases of which 55 cases were OGTT positive and diagnosed as GDM cases. Prevalence of GDM was found to be 2.75% in the 2000 patients studied. More than 25 years of age group had more prevalence of GDM. In the present study 41.82% were primigravida and 59.18% were multigravida, prevalence increased with gravidity. In the present study maternal complications observed were PIH 16.36% poly hydramnios 32.73% and infections in 3 cases. The prevalence of LSCS in the present study was 36.36%. Fetal complications observed were macrosomia, hypoglycaemia and

Manuscript submitted: 9 March 2022, Manuscript revised: 27 May 2022, Accepted for publication: 18 June 2022

hyperbilirubinemia. Conclusion: The prevalence of GDM is 2.75% in the present study and there is a greater prevalence of GDM in women with increasing age, high parity and increasing BMI.

Keywords---gestational diabetes mellitus, macrosomia, hypoglycaemia, oral glucose tolerance test.

Introduction

Gestational diabetes mellitus is carbohydrate intolerance during pregnancy because of the diabetogenic effects of pregnancy and return to normal carbohydrate tolerance after delivery. Almost all new cases of diabetes in pregnancy are a transient form of type II diabetes. A small proportion of cases of diabetes are found to persist after pregnancy. Most of these are type II DM. However rarely I DM type may arise during pregnancy.[1] Pregnancy is considered to be a diabetogenic state mainly characterized by increased insulin resistance and associated with decreased sensitivity to insulin at cellular levels. Hormones like estrogen, progesterone, human placental lactogen, cortisol and growth hormone are anti insulinogenic. These hormones increase in mid pregnancy period and cause abnormal glucose tolerance in some women rendering them prone for gestational diabetes.[2] Increased insulin destruction by kidney and placenta, increased lipolysis and the alteration in gluconeogenesis are also some of the reasons for the diabetogenic state in pregnancy.

Women with a history of GDM are at increased risk of future diabetes, predominantly type 2 diabetes, as are their children. The importance of GDM is that two generations are at risk of developing DM in the future. Abnormal glucose tolerance during pregnancy has adverse fetal outcome[3] like preterm delivery, malformations, altered fetal growth like macrosomia, stillbirths and maternal complications like preeclampsia polyhydramnios, infections, future diabetes mellitus. Increasing maternal carbohydrate intolerance in pregnancy without GDM is associated with increase in adverse maternal and fetal outcomes.[4] It is important to identify a pregnant woman with gestational diabetes mellitus because GDM is associated with significant metabolic alterations, increased perinatal mortality and morbidity, maternal morbidity and exaggerated long-term morbidity among the mothers and their offspring.

Universal screening of all pregnant women for GDM has been endorsed by both the American Diabetes Association Position Statement and by the First, second and third international workshop conferences on GDM.[5] American College of Obstetricians and Gynaecologists (ACOG) have emphasized on selective screening. The Fourth International Workshop conference in Gestational diabetes also endorsed on selective screening. Compared with selective screening, universal screening for GDM detects more cases and improves maternal and offspring prognosis. In the Indian context, screening is essential in all pregnant women as the Indian women have an elevenfold increased risk of developing glucose intolerance during pregnancy compared to Caucasian women. Another area of concern is that among ethnic groups in South Asian countries, the Indian women have the highest frequency of GDM.

Gestational diabetes mellitus affects about 7% of all pregnancies worldwide and recent studies have reported an increase in the prevalence in last two decades. The prevalence of Diabetes is increasing globally and these numbers include women with Gestational diabetes mellitus. Worldwide prevalence of GDM varies between 1.4 to 14%. In India the prevalence ranges from 6% to 9% in rural and 12 to 21% in urban areas. The prevalence of Gestational diabetes mellitus in India in 1980 was 2% only, in 1990 it was 7% and the recent data shows 16.55% prevalence of GDM in our country. There is strong evidence that this epidemic has been triggered by social and economic development and urbanization which are associated with general improvement in nutrition and longevity, obesity, reduced physical exercise and growth failure in infancy, increase susceptibility to diabetes etc. Indians have an 11-fold risk of developing diabetes mellitus during pregnancy.[5]

There is a lot of controversy regarding many aspects of GDM. Important being type of screening, whether universal or selective, which screening tests and diagnostic test to follow, about ideal cut off glucose levels, whether to treat or not, how best to treat so on and so forth. Unfortunately, there is no universally accepted gold standard for diagnosis of GDM & the commonly utilized methods and threshold criteria for diagnosis of GDM in themselves give different results. The Indian data on GDM is scanty and does not give the actual picture. India falls under high-risk group and with the advent of western life style, incidence of type II DM is raising steeply. The number of women with GDM is also raising, hence the need for this study. The data regarding prevalence of GDM and the number of women affected are important to allow for rational planning and allocation of resources and the preventive strategies that may be undertaken in future. Hence an attempt is made to know the prevalence of GDM and its adverse effect on mother and fetus. The need for universal screening and outcome of pregnancy in those with borderline values, mode of treatment, outcome in such pregnancies are presented here.

Materials and Methods

This is a prospective and observational study conducted in Government Maternity Hospital (GMH) Tirupati, in the antenatal women between 24 to 28 weeks gestational age attending to Government Maternity Hospital, Tirupati for a period of 6 months that is from January 2014 to June 2014.After fulfilling the inclusion criteria 2000 subjects selected in study.

Inclusion criteria

24-28 weeks pregnant women, all normal antenatal mothers those who are apparently healthy.

Exclusion criteria

Known diabetics, other medical complications. A total of 2000 patients were screened for gestational diabetes mellitus selected randomly who had gestational age between 24 weeks to 28 weeks. While all patients with history of diabetes mellitus prior to onset of pregnancy, other medical complicating disorders were

excluded. A proforma was used, and details pertaining to family history, medical and obstetric history were collected. Body mass index (BMI) and blood pressure (BP) were also recorded. Written consent was taken from the patients. Pregnant women were given 75grams of glucose dissolved in 200ml of water and the patient was asked to drink it within 5 minutes period, irrespective of time of the day and her last meal.

The time was noted and capillary blood sample is collected after 2 hours for estimating capillary blood glucose. Blood glucose levels are tested by glucometer with glucose strip method. If glucose value was ≥140mg/dl, the screening was considered as positive. Patient with GCT value of 200mg/dl or more were directly diagnosed as GDM without the need for OGTT. The GCT positive patients underwent diagnostic OGTT by 100gm of glucose. Three days prior to OGTT, patients were asked to take normal unrestricted diet. After overnight fasting of 8-14 hours, a fasting blood sample was drawn; following which 100gm of glucose dissolved in 300ml of water was given orally. Thereafter various plasma levels were assessed hourly for three hours. Patients were diagnosed as GDM by carpenter and coustan values.

Pre glucose level- 95mg/dl
1hour 180mg/dl
2hour 155mg/dl
3hour 140mg/dl if more than 2 values are abnormal diagnosed as GDM.

Those diagnosed as GDM were followed till delivery. Patient advised to attend to the hospital for regular antenatal check up every 15 days, and do ultrasound to know fetal wellbeing, liquor status and fetal growth. Routine investigations like blood urea, serum creatinine, blood sugar levels, are checked. Patient advised to attend to hospital for planning of delivery at 38 weeks of gestational age. Maternal and fetal outcome were studied. Data was entered in Microsoft excel, graphs were drawn using Microsoft and Microsoft excel. Data was analysed using SPSS software version 14. Chi-square test was applied wherever applicable and P value <0.05 was taken as significant.

Results

A prospective study was carried in 2000 women with 24-28 weeks gestation. Of the 2000 patients 1815 patients were responded came to the hospital for follow up. There was no adverse effect of nausea and vomiting. All the patients accepted the test readily with written consent.

Table 1
Distribution of GCT and OGTT Positive and Negative Cases

GCT				OGTT			
Positive	%	Negative	%	Positive	%	Negative	%
58	2.9	1942	97.1	55	5.17	3	94.8

Sensitivity: 94.8%
Specificity: 100%

Positive predictive value: 100%
Negative predictive value: 99.8%

Table 2
Age and BMI Distribution of GCT Positive Cases

Age	GCT Negative	%	GCT Positive	%
<20	419	21.58	5	8.62
21 to 24	666	34.29	18	31.03
25 to 29	590	30.38	22	37.93
≥30	267	13.75	13	22.41
703*; (p=0.03); df= 3				
BMI				
< 20	383	19.72	2	3.45
21 to 24	966	49.74	21	36.21
25 to 29	440	22.66	32	55.17
≥30	153	7.88	3	5.17
x2= 35.597; (p=0.000); df= 3				
Gravidity	No of cases	%	GCT +ve	%
Gravida I	1068	54.99	25	43.10
Gravida II	649	33.42	20	34.48
Gravida III	204	10.50	11	18.97
Gravida ≥IV	21	1.08	2	3.45
x2= 7.97*; (p=0.044); df= 3				
Delivery				
LSCS	159	8.76	20	34.48
Instrumental	130	7.16	2	3.45
NVD	1520	83.75	36	62.07
VBAC	6	0.33	0	0.00

**significant at 0.001 level ; p < 0.001

37.93% of GCT positive cases in the age group of 25-29 years. 8.62% less than 20years, 31.03% 21 to 24 years and 22.41% in the age group more than or equal to 30years. There is gradual increase in prevalence of GCT positive cases with increasing age. 60.30% of GCT positive cases had more than 25kg/m^2 BMI . 3.45% had <20 BMI, 36.21% had BMI 24. Higher the BMI more the risk of developing GCT positive. Higher the gravidity more the risk of developing GCT. 43.10% were gravida I, 56.90% were multigravida. 62.07% of GCT positive cases delivered by vaginally. 34.48% cases delivered by LSCS and 3.45% cases were instrumental deliveries.

Table 3
Birth weight of baby in GCT positive cases

Birth weight	No. of Cases	GCT-ve	%	GCT +ve	%
<2.5	579	578	32.90	9	15.52
2.6-3	355	353	20.09	18	31.03
3-3.5	749	749	42.63	25	43.10

≥3.6	77	77	4.38	6	10.34
x2= 18.918; (p=0.000) ; df= 3					

**significant at 0.001 level; p < 0.001

In the present study 43.10% babies were between 3kg to 3.5kg. Statistically significant.10.34% babies more than or equal to 3.6 kg weight.

Table 4
Distribution of GDM according to the maternal Age, BMI and gravida

Age	Non GDM	%	GDM	%
<20	384	21.82	3	5.45
21 to 24	621	35.28	17	30.91
25 to 29	544	30.91	22	40.00
≥30	211	11.99	13	23.64
BMI				
<20	323	18.35	2	3.64
21 to 24	900	51.14	19	34.55
25 to 29	383	21.76	31	56.36
≥30	154	8.75	3	5.45
Gravidity				
Gravida I	1000	56.75	23	41.82
Gravida II	550	31.21	19	34.55
Gravida III	191	10.84	11	20.00
Gravida ≥IV	19	1.19	2	3.64

P value <0.005 was statistically significant in age more than 25 years. 5.45% less than 20 years, 30.91% cases in between 21-24years, 63.24% cases in the age group more than or equal to 25 years. 56.36% of GDM cases had BMI in between 25-29kg/m^2, more than or equal to 30kg/m^2 BMI cases were 5.45%. Prevalence of GDM increasing with multigravida. 41.82% case primigravida, 58.19 cases multi gravida.

Table 5
Distribution of GDM according to the mode of delivery and birth weight of new-born

	Non GDM	%	GDM	%
Mode of Delivery				
LSCS	139	7.90	20	36.36
Instrumental	128	7.27	2	3.64
NVD	1487	84.49	33	60.00
VBAC	6	0.34	0	0
Birth weight of newborn				
<2.5	579	32.90	8	14.55
2.6-3	355	20.17	16	29.09

3-3.5	749	42.56	25	45.45
≥3.6	77	4.38	6	10.91
Grand total	1760	100	55	100

60% of the GDM cases delivered by vaginally. 36.36% were delivered by LSCS. 45.45% of the babies weight were between 3-3.5kg.

Table 6
Complications of pregnancy in GDM positive cases

Complications	Non GDM Cases	%	GDM cases	% (n= 55)
PIH	26	1.47	9	16.36
Polyhydramnios	10	0.56	18	32.73
Infection	-	-	3	5.46

Most common complications observed in this study was PIH and polyhydramnios. Other complications like PROM and hypothyroidism also observed.

Table 7
Neonatal complications in GDM patients

Complications	No. of Cases	%
Hypoglycaemias	3	5.45
RDS	0	0.00
Hyperbilirubinemia	2	3.64
IUD	1	1.82

One case of intra uterine death observed at term gestational age. 3 cases hypoglycaemic babies and 2 cases had hyperbilirubinemia.

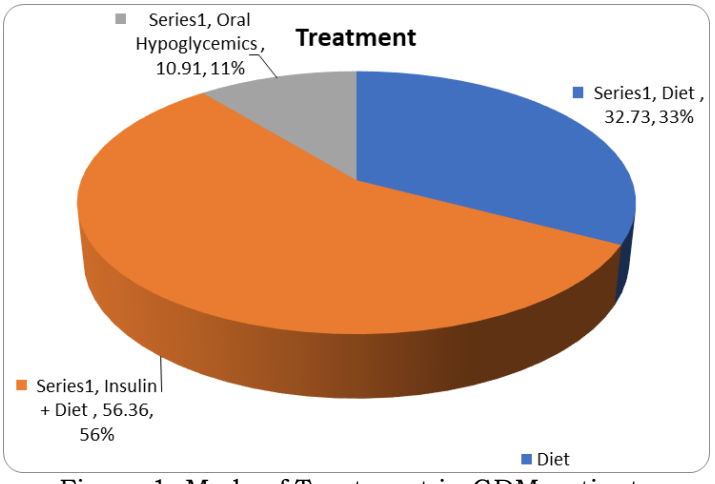

Figure 1. Mode of Treatment in GDM patients

56.36% of patients had blood sugars were well controlled with insulin and diet.

Table 8
Distribution of GDM cases according to risk factors

Risk factors	Total	GDM	%	X	P- value
Age >30yrs	224	13	5.803	6.69 **	P < 0.01
BMI >30kg/m^2	157	3	1.91	0.733	Nil significant
Gravida≥4	21	2	9.52	3.949*	P < 0.05

P value <0.5 was statistically significant in age >30 years and gravida more than equal to 4.

Discussion

"Gestational diabetes mellitus is carbohydrate intolerance of variable severity with the onset or first recognition during the present pregnancy." GDM is associated with important prenatal and long term healthy risks and many of the risks increase in relation to the severity of maternal hyperglycaemia. Out of 2000 women 1815 were followed till delivery, 55 women were diagnosed as GDM. The prevalence of GDM was 2.75%.

Table 9
Prevalence of GDM in comparision with other studies

AUTHOR	YEAR	PREVALENCE
V. Seshaiah (Tamilnadu)[5]	2005	16.2%
Ahia Garshsbi (Tehran)[6]	2008	6.8%
Rajesh Rajput (Haryana)[7]	2013	7.1%
Malik Waseem Raja[8] (Kashmir)	2014	7.8%
Subirana Jesmin [9] (Bangladesh)	2014	9.7%
P.V. Raghava Rao [10] (Guntur-A.P)	2015	2.5%
Present Study	2015	2.75%

The prevalence of GDM in present study was 2.75%. Out of 55 women 40% of women are between 25 -29years age group, 30.91% had an age between 21-24years and 23.64% had an age of more than 30years. Regarding BMI the 56.36% women were between the range of 25-29, 5.45% had a BMI more than 30. 39.29% had normal BMI. About gravidity 41.82% women were primigravida, 58.19% were multi gravida. Women of more than 25years are being considered as risk factor this is the same statement of many studies like Seshiah.[5] In our study population 63.4% of women were between the age group of 25-35years. The increase in BMI is also a risk factor for diabetes mellitus. Parity and gravidity were also showing influence on gestational diabetes mellitus in our study multigravida were more than primigravida.

In India, a study was done in 1982 and the prevalence of GDM was found to be 2% and in random survey performed in various cities in India in 2002-03, the

prevalence of GDM was 16.2% in Chennai, 15% Thiruvananthapuram, 12% in Bangalore, 18.8% in Erode and 17.5% in Ludhiana. Subrina jesmine et al[9] showed that the prevalence of GDM in Bangladesh higher in educated, higher household income and higher parity. V. Seshaiah et al[5] showed that ethnically Indian women have high prevalence of diabetes and the relative risk of developing GDM in Indian women 11.3 times compared to white women. Indian population is ethnically proved to high prevalence of type II DM. Worldwide prevalence of GDM varies between 1.4 to14%, in India varies from 3.8 to 21% in different parts of the country depending on the geographical locations and diagnostic methods used.

Table 10
Comparison of validity of the test

	Specificity	Sensitivity	Positive predictive value
Carpentar et al [11]	76%	--	22%
Coustan et al[12]	78%	90%	9%
Anjalakshi et al [13]	100%	100%	--
Present study	100%	94.8%	100%

The specificity of the test was 100% in Anjalakshi et al[13] and also in our study, so were the sensitivity test with 75gm glucose. The positive predictive value was high compared to carpenter and coustan's study indicating that screening with 75grams glucose is a more sensitive test in detecting GDM. Sheshiah et al[5] report from their study that using 75gm glucose at 2hr plasma glucose ≥140mg/dl as one step procedure is simple and economical, particularly for the countries ethnically prone to high prevalence of GDM. Anjalakshi et al[13] in their study of 800 pregnant women diagnosed as GDM by 75gm GCT glucose, irrespective of the last meal timings, found no statistically significant (P>0.005) between the plasma glucose levels of GCT and WHO GTT performed in the GDM and the normal glucose tolerance pregnant women.

Esakoff et al[14] also examined if the screening criteria should be modified depending on the ethnicity of the subject being tested. Bonomo et al[15] recommended the threshold of 140mg/dl as a cut off point for screening GDM, as the lower threshold values are associated with high false positive rate, increasing the economic burden. Taking 140mg/dl as cut off point, only 14% require OGTT whereas, 23% require OGTT with 130mg/dl as a cut-off point. If the prevalence of GDM is high in a particular population group, a cut-off point of 130mg/dl is a reasonable threshold level. And a higher false positive is also acceptable. In the present study cut off point of glucose level was 140mg/dl as per DIPSI guidelines. Maternal age in an established risk factor for gestational diabetes mellitus (GDM), but there is no consensus on the age above which there is significantly increased risk of GDM. In the literature the lowest cut off is ≥25 years, as recommended by the American Diabetes Association (ADA) . Though the prevalence in different age groups varies, in all studies there is an increase in prevalence of GDM as the age advances.

In the present study out of 2000 participants, 35 women had GDM with the majority older than 25 years. The present study shows 40% of GDM cases were

belonging to the age group of 25 to 29 years. V Seshaiah[5] et al finding indicates that the prevalence proportion increased with age from 14.5% in the age group of 15-19 years to 25% in the age group ≥30years. With regard to the age effect, a model of linear trend was statistically significant. In P.V. Raghava Rao et al[16] study 20% of GDM patients were in the age group of 21-25 years, 40% of GDM patients were in the age group of 26 to 29 years, 40% cases were in the high risk age group of ≥30 years. There is increasing prevalence of GDM with increasing age. Terence T. Lao et al [17] finding that the risk of GDM becomes significantly and progressively increased from 25years onwards. This supports the American Diabetes Association (ADA) recommended on the use of age ≥25 years as the cut off for screening and the observation that maternal age ≥25years is the factor most predictive of GDM.

Multiple studies support the idea that GDM appears more frequently in pregnancy after the age 25 because of age related metabolic changes like increased BMI, hypertension and dyslipidemic and it is rare before age 20. In the present study prevalence of GDM increasing with BMI more than or equal to 25 to 29, the relationship between BMI and GDM was significant and p value was <0.001. V. Seshaiah et al[5] study showed that the prevalence of GDM increased with increasing BMI. K. Sreekanthan et al[18] study showed that the relationship between BMI and diabetes mellitus (DM) was highly significant and p value was 0.003. Alpana Singh et al[19] study showed obesity is a significant risk factor for GDM, causing hormonal imbalance of carbohydrate regulation mechanism and insulin sensitivity. Bener A et al[20] in Quatar study showed that the risk of GDM increased steadily with maternal BMI, and obesity emerged as an essential risk factor for subsequent GDM.

The prevalence of proportion of GDM increased with gravidity, from 16.3% in the primigravida's to 25.8% in gravida more than or equal to 4 in Seshiah et al[5] study. In Malik Waseem Raja et al[8] study the association was found statistically significant <0.005. In the present study out of 55 diabetics, 41.82% diabetics were primigravida 59.08% diabetics were multigravida women have one or more children the p value is <0.005 it was statistically significant. Abdulbari Bener et al[20] concluded that increased parity was a risk factor for GDM. Established risk factors for GDM are advanced maternal age, obesity and family history of diabetes. Sheshiah et al noted increase in the prevalence of GDM in their study and attributed it to increased BMI, as high maternal weight is associated with a substantially higher risk of GDM. In the present study the prevalence of GDM increasing with age and gravidity, these risk factors were significant p value for age group was <0.01 and p value for gravidity was <0.05. Ahia Garshasbi[6] et al study, the prevalence of GDM steadily increased with advancing age a multiple logistic regression analysis parity was not found to affect GDM prevalence significantly. Increased parity is often associated with other risk factors like increasing age, body weight and abdominal fat deposition. Bener A et al[20] study showed that most common risk factors observed in the studied women with GDM were advanced maternal age, low economic status, increasing maternal BMI, family History of diabetes, and parity.

Table 11
Maternal complications in GDM pregnancy

Authors	Polyhydrannios	PIH
Priyanka Karla[21]	-	36.4%
Ritu Joy[22]	-	27.2
Alpana Singh[19]	8.7%	8.7
Present study	32.73%	16.36%

In the present study, polyhydramnios rate was more in GDM patients followed by pregnancy induced hypertension and infections. So control of blood sugar level was needed. The most significant maternal risk with GDM is the 35-50% probability of developing type II diabetes later in life. Older studies indicated a significant increase in prevalence of PIH. A prospective study on 1310 women in Iran showed that GDM women had higher rate of hypertension, polyhydramnios and caesarean section. Priyanka Karla[21] study revealed that the most common complications seen in GDM mothers were gestational hypertension followed by infections, premature rupture of membrane and abruptio placentae. Ritu Joy[22] study showed the PIH, and hypothyroid also has correlation with gestational diabetes mellitus. The comorbid conditions like PIH trigger the caesarean delivery in gestational diabetes mellitus.

In the present study 7.27% had macrosomic babies 5.45% were hypoglycaemias, and 1.82% had hyperbilirubinemia and 1.82% were intra uterine foetal death. Preterm deliveries also observed. The strict glycaemia control in gestational diabetes mellitus women not showed any increased risk in preterm delivery. In Government Maternity Hospital Tirupati 14,138 deliveries were conducted among these deliveries 2,971 cases were under gone to LSCS. 21% were under gone LSCS. In the present study LSCS rate was more in the GDM patients compared to the general population. In the present study compare to non GDM cases caesarean section is higher in GDM cases. In non GDM cases 7.9% and GDM cases 36.36% was present. Alpana Singh et al study showed increased rate of caesarean section.

The prevalence of caesarean section is higher than in the non-diabetic population, but possibly this is a consequence of the diagnosis and not the condition. A clearly increased risk of caesarean delivery among treated patients compared with normoglycemic controls persisted after adjustment for multiple maternal risk factors. In the present study most of the GDM cases respond to insulin and diet therapy. Among South Asian countries, Indian women have 11 fold increased risk of glucose tolerance during pregnancy compared to Caucasian women. Hence the universal screening during pregnancy has become important in our country as this might decrease the delay in the diagnosis and care of GDM patients.

Conclusion

Gestational Diabetes Mellitus can be present in antenatal women even without risk factors. Hence there is a need for universal screening. Glucose challenge test with 75gm glucose at 2 hours is highly sensitive in detecting GDM. The prevalence of GDM is 2.75% in the present study and there is a greater

prevalence of GDM in women with increasing age, high parity and increasing BMI. Timely intervention with diet, insulin therapy, patient education and team approach for the treatment improves the maternal and foetal outcome of pregnancy. Gestational diabetes is an important public health issue because women who have GDM have higher risk of type II diabetes in the future and second generation. Early detection and treatment of GDM with insulin and life style modification decreased adverse outcome of the pregnancy.

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