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**Original Research Article**

# Efficacy of early versus late postpartum DIPSI test in gestational diabetes mellitus women for follow up

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## ABSTRACT

**Background:** The present study aimed to evaluate if postpartum gestational diabetes mellitus (GDM) screening can be performed during immediate post-delivery 72 hrs instead of six weeks postpartum for follow-up.
**Methods:** Total 150 GDM patients were included. The sample size was calculated as 150 with Nimaster2.0 software. GDM patients are enrolled after meeting the exclusion criteria for the study. The GDM diagnosis was made by DIPSI test and treated as per guidelines. After delivery, the Dipsi test was done on PND-3 (PP1). Furthermore, all were kept on LSM irrespective of the glycaemic level DIPSI test was repeated in all Patients after 45 days (PP2).
**Results:** All 150 patients had a DIPSI test on 3rd day post-partum (PP1) and repeat test at 45 days (PP2)., Of these, 60 patients (40%) showed negative DIPSI test on P1 and all remained in Group 1, with 63 patients having negative DIPSI test on PP2. 50 patients (33.3%) had blood glucose between 140-199 mg (Group 2) on PP1 and increased to 53 patients in PP2 in 45 days. 40 patients had diabetic (26.6%) value (Group 3) in PP1, and out of them 34 (22.6%) remained in group 3 in PP2 after 45 days post-partum.
**Conclusions:** This pilot study shows that nearly 60% of the GDM patient have either IGT or diabetic value following delivery on 3rd day of PP1 and almost similar results in PP2. Hence, we can do the postpartum screening on the postpartum 3rd day and need not wait for 6 wks when more than 50% is lost for follow-up. This study shows among GDM 60% of them have underlying beta cell dysfunction.

**Keywords:** DIPSI test, Gestational diabetes mellitus, Glucose tolerance test GTT, LSM lifestyle modification, Postpartum screening

## INTRODUCTION

"GDM is the mother of NCD" -These are the words of the father of GDM, Padmashri Dr. V Seshiah. GDM is the most typical medical disorder in pregnancy, affecting every 5th pregnant Woman (20 to 25%).[1,2] GDM reflects impaired maternal insulin secretion relative to demand before pregnancy and temporary metabolic stress imposed by the placenta and fetus.[2,3] It is well-known that GDM produces short-term and long-term metabolic effects on the mother and the neonate and causes transgenerational transmission. Women with h/o GDM remain at an increased long-term risk of developing T2DM compared to their counterparts with no GDM history and are more likely to develop GDM in a subsequent pregnancy.[4]

Following GDM, the risk of overt diabetes immediately after pregnancy is 10%, 80% of GDM women developed

T2DM within 5 yrs.[5,6] several risk factors mediate T2DM like insulin sensitivity and secretion, intrapartum stresses upon beta cell function, intrapartum accretion of energy stores that persists after delivery and postpartum behavior, fasting hyperglycemia, high BMI at the time of diagnosis of GDM and in addition they are at higher risk of cardiovascular complications due to dyslipidemia, hypertension, and abdominal obesity, unfavorable changes in HDL & TGL levels compared with women with healthy pregnancy Women with a history of GDM also prone for recurrent GDM and had higher intimal medial thickness compared with women without a history of GDM.[7-10]

Postpartum glucose testing is a golden opportunity to identify women with persistent glucose intolerance.[11,12] The best way to prevent the development of T2DM in patients with GDM is postpartum screening so that appropriate intervention can be taken at the earliest.[13] Timely diagnosis also serves as secondary prevention of long-term complications associated with DM, and early postpartum follow-up is crucial for establishing and maintaining lifestyle changes that decrease the risk of T2DM later in life or delay its onset.[14,15] Tight glycaemic control is also essential for the health of future pregnancies. ACOG recommends post-partum screening at 4 to 12 weeks, while Indian National guidelines recommend screening at 6 to 12wks.[16]

In practice, it has been observed that most women could not come for follow-up GTT after 6 wks because of several barriers. The barriers are no family support, absence of self-care, altered priorities, not understanding the necessity of the test, considering themselves as healthy, long distances to healthcare services, shifting places after delivery, poverty, and lack of awareness of public health services.

To overcome this problem, it has been thought that the insulin resistance offered by placental hormones goes off once the placenta is delivered. Hence fasting or non-fasting GTT of DIPSI can be performed either on the 3rd or 4th postnatal day so that there will be 100% coverage of all GDM women. As women generally stay in the hospital till 3rd day postpartum, it is easier to screen nearly all the pts at that time by the test they use and also, if found dy-glycaemic appropriate preventive intervention may be started after counselling immediately before discharge. Since these women have already had a pregnancy with hyperglycemia and understand feto-maternal risks and associated complications, they may be better sensitized to continue lifestyle measures and pharmacotherapy as required. It may play a significant role in universal coverage for postpartum screening, early diagnosis of IGT, and timely intervention will prevent the progression of these women to T2DM and associated metabolic syndrome.[16,18]

Few recent studies have explored the diagnostic accuracy of 2-4th day. GTT with 4-12 weeks OGTT and have encouraging results.[19,20,21] However, so far, there is no Indian such study. Hence in this pilot study, we have compared the 3rd or 4th-day DIPSI test (PP1) with 6wks postpartum DIPSI test (PP2) for diagnostic accuracy. This test will make it possible to shift the screening test while the Woman is still in the hospital after delivery.

In recent years, GDM has rapidly increased incidence in keeping pace with the global upward trend of obesity, T2DM, and other metabolic diseases.[22,23] T2DM is an important sequela of GDM, and close postpartum follow-up is critical to prevent and treat this disease promptly. We found a low rate (38.9%) of postpartum screening for diabetes among women in US hospital in urban community.[24] In a study in Europe, more than 60% of the women with GDM did not participate in postpartum diabetes screening.[25]

The field health workers who care for pregnant women during the antenatal period should be sensitized about the importance of postpartum follow-up. For them to perform postpartum screening for glucose intolerance, the test has to be simple, doable, and evidence-based. The public health care ASHA workers are already performing GDM screening by a "single step procedure" of diagnosing GDM with 2-hour PG >140mg after 75g oral glucose load without regard to last meal timing, which will be called DIPSI test hereafter, which is recommended by Ministry of Health, Government of India.[26,27] This same test procedure can be followed to detect glucose intolerance in the postpartum period also.

## METHODS

This was prospective cohort study conducted in the Institute of Social Obstetrics and Government Kasturba Hospital, Triplicane, Chennai -5 with Study period 6 months (1st December 2022 to 31st June 2023). The ethical approval was taken from the ethical committee of the Institute.

The 150 postpartum women with known GDM who delivered in ISO-KGH between January and August, 2022 participated in this study. The diagnosis of GDM was made as per National guidelines and treated as per guidelines. Average PP blood sugar was between 120 to 130mg% during the antenatal period.

### *Inclusion criteria*

Inclusion criteria were all GDM patients were delivered at KGH.

### *Exclusion criteria*

Exclusion criteria were known cases of T1 o T2 DM, associated medical disorders like GHTN, heart disease, seizure disorder, coronary artery disease, and Women with postpartum complications of PPH and fever.

After enrolling the GDM patients after meeting the exclusion criteria for the study DIPSI test was done on the postnatal day 3 irrespective of LSCS or normal delivery. The meal plan is advised for everyone. They were counseled well to come for a DIPSI test after 6 wks post-partum on the 45th day. A reminder call was given through mobile, SMS, Whats app, and through the area health worker. The demographic data were analysed. The DIPSI test value of the 3rd day and 45 days was grouped into Group 1; <140mg% normal, Group 2; 140 to 199 mg% as IGT and Group 3; ≥200mg% as diabetic, and the sensitivity and specificity and positive and negative predictive values were calculated.

### *Statistical analysis*

The statistical analysis was done with Medcalc Software version 22.

## RESULTS

Sensitivity of 100% and specificity of 95.2% is very high in predicting post-partum IGT and diabetes on 3rd day postpartum in GDM women as good as 45 days, where women do not turn up for follow-up for postpartum screening.

### *Characteristics and outcomes of GDM pregnant women*

Out of 150 pts, 128 were below the age of 30yrs (85) % and 41 (15%) above 30yrs.positive family history was present in 57%, 108 (72%) pts were overweight, and four were obese. In this 50% oi, previous fetal wastage was present in 21%. All had good glycaemic control. During antenatal, their PPBG values are between 120 to 130 mg%. After delivery, 55% stayed in the hospital for > 4 days, and 17% stayed for eight days (Table 1).

**Table 1: Characteristics and outcomes of GDM pregnant women.**

| Characteristics | No. of patients | % | Remark |
|---|---|---|---|
| **Age of GDM** | 150 | 100 | |
| >30 | 22 | 15 | |
| ≤30 | 128 | 85 | |
| **Parity** | | | |
| Gravida 1 | 74 | 49.3 | |
| Gravity 2 | 57 | 38.0 | |
| Gravida ≥3 | 19 | 12.7 | |
| **Family H/O DM** | | | |
| Yes | 86 | 57 | |
| No | 64 | 43 | |
| **BMI** | | | WHO guidelines |
| <18.5 underweight | 1 | 0.7 | |
| 18.5 -24.9 (Normal) | 38 | 25.3 | |
| 25 to 30 (Overweight) | 107 | 71.3 | |
| >30 (Obese) | 4 | 2.7 | |
| **Previous foetal loss** | | | |
| Present | 31 | 21 | |
| Absent | 119 | 79 | |
| **Mode of delivery** | | | |
| Labour natural | 94 | 63 | |
| LSCS | 56 | 37 | |
| **Gestational age at delivery** | | | |
| At term | 122 | 81 | |
| Preterm (<37 completed weeks) | 28 | 19 | |
| **Duration of stay** | | | |
| >4 days | 82 | 54.7 | |
| 5-7 days | 42 | 28.0 | |
| >8 days | 26 | 17.3 | |
| **Treatment during the ante-natal period** | | | |
| Meal plan | 115 | 77 | |
| OHA (Metformin) | 29 | 19 | |
| Insulin | 6 | 4 | |
| **Postnatal complications** | | | |
| UTI Max hospital stays 5 days | 8 | 5.3 | |
| Breast engorgement Max hospital 6 d | 5 | 3.3 | |

Continued.

| Characteristics | No. of patients | % | Remark |
|---|---|---|---|
| Episiotomy wound gaping | 2 | 1.3 | |
| LSCS wound gapping | 1 | .67 | |

**Table 2: The mean and SD value of DIPSI test on 3rd day and 45th day of the same patients by Group (mg/dl).**

| Group | Number | 3rd day | 45th day | P- value |
|---|---|---|---|---|
| | | Mean ± SD | Mean ± SD | |
| **Group-1 (<140 mg/dl)** | 60 | 128.0±10.0 | 130.2±8.8 | 0.20 |
| **Group-2 (140 -199 mg/dl)** | 50 | 166.0±12.53 | 173.2±13.05 | 0.005 |
| **Group-3 (>200 mg/dl)** | 40 | 226.9±28.23 | 217.9±30.89 | 0.17 |

Based on the findings, the DIPSI-3rd day and 45th-day values are normal in group-1 and found there is a non-significant (P, 0.20) difference between the mean values. In group-2 there is a significant (<0.005) increase is observed between the mean DIPSI values, the increase of 7.2mg/dl is found between the DIPSI values. In the case of group-3, there is a non-significant (P, 0.17) decrease is observed between the mean DIPSI values, a decrease of 8.9mg/dl is found between the DIPSI values. In group-1 and group-3 the observed difference either increase or decrease, it is less than 10mg/dl in our study which is not very significant and can be ignored. Hence the 3rd postnatal DIPSI can be used for follow-up of GDM patients and there will be 100% coverage and we can initiate appropriate steps like counselling, MNT, and pharmacotherapy if needed. Thus, we can prevent the recurrence of GDM and prevent or postpone T2DM and CVS events.

**Table 3: Diagnostic test.**

| Disease present | Disease absent | Total |
|---|---|---|
| **87** | 3 | 90 |
| **0** | 60 | 60 |
| **87** | 63 | |
| **Results (%)** | | |
| **Sensitivity** | 100 | 95.84 to 100 |
| **Specificity** | 95.23 | 86.1 to 99 |
| **AUC** | 0.96 | 0.937 to 0.994 |
| **Positive likelihood ratio** | 21.00 | 6.96 to 63.362 |
| **Negative likelihood ratio** | 0.000 | |
| **Disease prevalence** | 60.00 | |
| **Positive Predictive value** | 96.923 | 91.259 to 98.959 |
| **Negative predictive value** | 100.00 | 94.037 to 99.626 |
| **Accuracy** | 98.095 | 94.406 to 99.626 |

About 150 GM patients who delivered in KGH were enrolled in this study. 85% were <30 years old, 49.3% were Primi, and 12.7% were Gravida 3 or more. The family history of DM was present in 57%. 71.3% of subjects were overweight, and 27% were obese. Previous fetal wastage was present in only 21%, 63% were delivered vaginally, labor was induced in 87%, and preterm delivery was in 19%. Duration of stay in the hospital <4 days in 54.7% and >8 days in 17.3%. 73.3% of babies weighed between 2.5 to 3.5%. 79.3% of babies were with good APGAR scores. NICU admission in 11.3% and 25.3% were admitted to NICU for BG monitoring. In managing hyperglycemia, 39% had good glycaemic control with MNT alone, and 61% required pharmacological therapy (48% OHA and 13% on insulin, whose BG was >200mg%). On postnatal D3, all were advised to follow a meal plan. On PND 45, they have been advised of treatment according to their BG in PP2. Postnatal morbidities like UTI, breast abscess, episiotomy wound gapping, and LSCS wound gapping were present in 11% of the subjects.

In analyzing the DIPSI test, the subjects were divided into 3 groups, Group 1- the DIPSI test 2rPGBG value <140mg% 60 patients on D3 and 57 on D45. On cross-tabulation of DIPSI D3 and D45; 60 in group 1 (<140) 95.2% (57cases) remained in group 1, after 45 days (1.6%), 1 case went into Group 2 (140 to 199), and 2 cases became Group 3 (3.2%), which is >200mg%. The mean and P values were not statistically significant. In Group 2 (140 to 199mg), on the D3 DIPSI test, 50 cases in group 2 remained in group 2 on D45. The mean and P values were statistically significant. In Group 3 (>200mg), 40 cases of D3 remained in group 3 on the D45 test, and their mean and P values were not statistically significant. The total diagnostic accuracy was 98%.

## DISCUSSION

The antenatal care of women with GDM in close routine pregnancy care, diagnosis and management, and postpartum follow-up. The early postpartum period is essential to identify the risk of diabetes mellitus in women with GDM. The OGTT test can help to guide lifestyle management and reduce the future risk of T2DM. Three previous studies, Nabuco et al Werner et al and Aaghdam et al evaluated postpartum women with second-day

OGTT.[21,16,17] The number of patients who presented for OGTT2 in these studies was fewer than the current study's patients. In the recent study, we were able to perform the DIPSI test on D45 in 100% of cases, which was possible with good counseling, creating awareness among the family members and health workers, and reminder calls to the patient and health worker by mobile SMS and whatsapp.[28]

In our study, out of 150 patients, only 60 patients became normal after delivery with a DIPSI test <140m. The remaining 90 patients showed either abnormal value; the numbers are almost identical on D3 and D45 tests. If the patients were asked to come between 6-12 weeks of postpartum and if they did not report, we would have missed 60% of patients who had dysglycemia. The screening test on day D3 when the patients are still in the hospital (for both Normal and C-section delivery), we can have 100% coverage and appropriately advise them on LSM and medication, which will prevent or postpone the onset of diabetes and its complications.

The present study revealed that the early DIPSI test is a useful, valuable test, and the results are consistent with those of the routine test after six weeks is 95.2%. The prevalence of abnormal results in the D3 test is 33.3% and Comparison with Naser, whose studies showed 31.8% pre-diabetic 20.6% DM and D45 test does not correlate, pre-diabetic 11.2% and diabetic 5.6% and in the present study, same as D3 that is 33.3% and 26.6%, respectively. In the present study, only LSM was advised for everyone following the test. In the study of Nabuco et al the results of OGTT 1 and 2 were 32.9%, and 20.7% is consistent with the present study.[21]

In our study, the DIPSI 1 would detect IGT and Diabetes (abnormal results) with a sensitivity of 100% and specificity of 95.24%. Weijers et al.; reported that D2 postpartum OGTT was 100% sensitive and 94% specificity for abnormal values, and this study correlates well with our present study.[4] At the same time, the Naser study shows a sensitivity of 82.14% and a specificity of 70.89%.[16]

The expected results of OGTT 1 obtained by Werner and Nabuco, and align with the desired OGTT after six 6 weeks is the same in the present study.[16,21] Hence, an early DIPSI test on day 3 during hospitalization is feasible and helpful in identifying high-risk patients. This study showed only a 40% return to pre-pregnancy glycaemic status almost immediately. However, the endocrine society recommendation is to check glucose concentration 24-72 hours after the delivery to exclude permanent hyperglycaemia; several women with GDM may suffer from previously undiagnosed T2DM. In our study, it is 26.6%.

In this study, nearly half of the patients used anti-glycaemic drugs, and DIPSI 1 and 2 were significantly positive in these patients. This is probably due to the severity of diabetes in these patients; therefore, they will continue with diabetes mellitus after delivery. This study has several limitations. All patients were advised only LSM after delivery; no pharmacological treatment was used.

This study has few limitations. As single tertiary care hospital was used in this study, therefore we need multi-centre study with different regional to generalised finding for whole population.

## CONCLUSION

This pilot study shows that nearly 60% of the GDM patient have either IGT or diabetic value following delivery on 3rd day of PP1 and almost similar results in PP2. Hence, we can do the postpartum screening on the Postpartum 3rd day and need not wait for 6 weeks. when more than 50% is lost for follow-up. Of them, 30% will develop diabetes. If preventive measures are s not taken, 30% will progress to immediate postpartum diabetes and its complications if not treated promptly. This study shows among GDM 60% of them have underlying beta cell dysfunction. This study shows early postpartum screening using the DIPSI test, which patients and healthcare providers have used for a long time. Furthermore, this effectively diagnoses women who are at high risk for diabetes, and this can replace the conventional 6 weeks DIPSI test. The maximum number of GDM patients can be screened by early testing and steps to prevent the onset of diabetes and prevent possible complications. Finally, to prevent NCD, the solution is to sensitize the government, which has a well-placed health delivery system, about the importance of GDM screening during pregnancy and glucose intolerance in the early postpartum period.

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