FOGSI

MEDICAL DISORDERS IN PREGNANCY COMMITTEE

GDM Updates

VOL.: 1 | 14th Nov. 2020

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Diabetes has become a health hazard all over the world and so is Gestational Diabetes. We Indians as a part of the Asian ethnicity are more predisposed to Diabetes. Diagnosis and treatment of Gestational Diabetes is the first step to reduce the chance of Type 2 Diabetes in the female and prevent future health issues in the baby. On the occasion of World Diabetes Day on 14th November, we decided to bring to you some basic facts about screening, Fetopathy and management of GDM Hope you enjoy the articles in this newsletter.

Wish you a very Happy Diwali.

Regards

FOGSI Medical Disorders In Pregnancy Committee

SCREENING METHODS FOR GESTATIONAL DIABETES MELLITUS

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Diabetes Mellitus is becoming a big health issue all over the world, not just in the general population but also in the pregnant women. Out of the women who have diabetes during pregnancy, it is estimated that approximately 87.5% have gestational diabetes (which may or may not resolve after pregnancy), 7.5% have type 1 diabetes and the remaining 5% have type 2 diabetes. The prevalence of type 1 diabetes, and especially type 2 diabetes, has increased in recent years. The incidence of gestational diabetes is also increasing as a result of higher rates of obesity in the general population and more pregnancies in older women.[1]

Gestational Diabetes Mellitus (GDM) is defined as any glucose intolerance with the onset or first recognition during pregnancy.2 This definition helps for diagnosis of unrecognized pre-existing Diabetes also. Hyperglycaemia in pregnancy is associated with adverse maternal and prenatal outcome. The adverse maternal complications include hypertension, preeclampsia, urinary tract infection, hydramnios, increased operative intervention and future DM. In the fetus and neonates it is associated with macrosomia, congenital anomalies, metabolic abnormalities, RDS, etc. and subsequent childhood and adolescent obesity.

It is important to screen, diagnose and treat Hyperglycaemia in pregnancy to prevent an adverse outcome. There is no international consensus regarding timing of screening method and the optimal cut-off points for diagnosis and intervention of GDM.[3]

WHOM TO SCREEN

According to American Diabetes Association screening should be done only for high risk women.

1. Body mass index more than 30 kg/m^2
2. Previous macrosomic baby weighing 4.5 kg or more
3. Previous gestational diabetes
4. Family history of diabetes (first-degree relative with diabetes)
5. Family origin with a high prevalence of diabetes
   South Asian (specifically women whose country of family origin is India, Pakistan or Bangladesh), Black Caribbean, Middle Eastern (specifically women whose country of family origin is Saudi Arabia,United Arab Emirates, Iraq, Jordan, Syria, Oman, Qatar, Kuwait, Lebanon or Egypt)
6. Clinical conditions associated with insulin resistance like PCOD

In risk based screening GDM was found in 1.45% of women as against universal screening which showed 2.7% in the same population showing that risk based screening has missed half of the GDM.4 Based on these facts **there is a need for universal screening especially in South east Asians countries more so in Indian women as they have high prevalence of Type II DM and genetic predisposition. FOGSI and FIGO recommend universal screening**

WHEN TO SCREEN

FOGSI recommends screening of every pregnant woman at the 1st visit using the DIPSI guidelines

Seldom, a pregnant woman visiting the ante-natal clinic for the first time comes in the fasting state. If she is asked to come on another day in the fasting state she may not return. Hence it is important to have a test that detects the glucose intolerance without the woman necessarily undergoing a test in the fasting state and it is preferable to perform the diagnostic test at the first visit itself.[6]

Screening for GDM is usually done at 24-28 weeks of gestation because

1. Insulin resistance increases during the second trimester and glucose levels rise in women who do not have the ability to produce enough insulin to adopt this resistance.
2. Placental hormones mediate insulin resistance which increases GDM as the pregnancy advances so testing too early may not be helpful in some patients.
3. Performing tests too late in third trimester limits the time in which metabolic interventions can take place.

Nice Guidelines in 2015- Assess risk of GDM using risk factors in a healthy population. If women had GDM in previous pregnancy do 75g OGTT as soon as possible, if negative repeat again at 24-28 weeks. Other women with any other risk factors screen at 24-28 weeks by 2-hour OGTT with 75 g glucose load.1

It is also known that, Insulin is detectable in the fetal pancreas as early as 9 weeks after conception. An increase in pancreatic beta cell mass and insulin secretion in the fetus occurs by the 16th week of gestation, in response to maternal hyperglycemia. The priming of the fetal beta cells may account for the persistence of fetal hyperinsulinemia throughout pregnancy and the risk of accelerated fetal growth. **This necessitates performing the test procedures to diagnose GDM in the first trimester itself.**

By following the usual recommendation for screening between 24 and 28 weeks of gestation, the chance of detecting unrecognized type 2 diabetes before pregnancy (pre- GDM) is likely to be missed. If the 2 – h PG is > 200 mg/dl in the early weeks of pregnancy, she may be a pre-GDM and A1c of > 6 is confirmatory {Normal A1c levels during pregnancy is 5.3 – 6}. A pregnant woman found to have normal glucose tolerance [NGT], in the first trimester, should be tested for GDM again around 24th – 28th week and finally around 32nd – 34th week.[6]

SCREENING METHODS

World Health Organization (WHO)- 75g 2hr OGTT

2 blood samples are taken

1. Fasting blood sample

   75g glucose is diluted in 250- 300ml water is ingested

2. 2hr post glucose

Venous plasma glucose of ≥140 mg/dl (7.8mmol/l) at 2-hour are classified as having GDM.

DIPSI (Diabetes in Pregnancy Study Group India)

A single step procedure irrespective of the last meal. Pregnant women attending the antenatal OPD were given 75g anhydrous glucose in 250-300ml of water and plasma glucose was estimated after 2 hours. This single step screening method is recommended by both FOGSI and FIGO.

Criteria	In Pregnancy	Non -Pregnant
2hr > 200mg/dl	Diabetes Mellitus	Diabetes Mellitus
2hr > 140mg/dl	GDM	IGT
2hr > 120mg/dl	DGGT	

DGGT–Decreased gestational glucose tolerance, IGT – Impaired glucose tolerance

International Association of Diabetes and Pregnancy Study Group (IADPSG) Criteria.[5]

OGTT is done in the fasting state using 75 g of glucose at 24-28 weeks
Fasting- ≥ 92 mg/dl (≥ 5.2 mmol/l)
1hr- ≥ 180 mg/dl (≥ 10 mmol/l)
2-hour ≥ 153mg/dl (≥ 8.5 mmol/l)

American Diabetes Association (ADA), 2015 Criteria

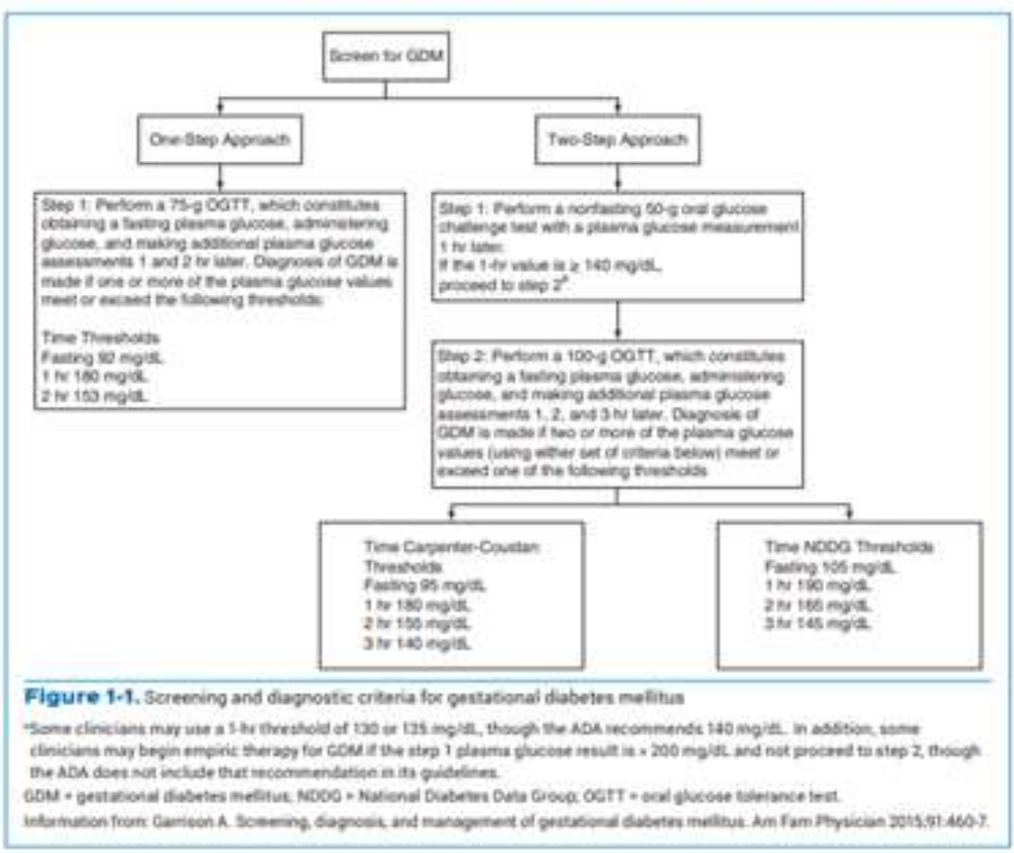

Figure 1-1. Screening and diagnostic criteria for gestational diabetes mellitus

*Some clinicians may use a 1-hr threshold of 130 or 135 mg/dL, though the ADA recommends 140 mg/dL. In addition, some clinicians may begin empiric therapy for GDM if the step 1 plasma glucose result is > 200 mg/dL and not proceed to step 2, though the ADA does not include that recommendation in its guidelines.

GDM = gestational diabetes mellitus; NDDG = National Diabetes Data Group; OGTT = oral glucose tolerance test.

Information from: Garrison A. Screening, diagnosis, and management of gestational diabetes mellitus. Am Fam Physician 2015;91:460-7.

Conclusion-

Screening and diagnosis of GDM and treating it effectively not only prevent adverse maternal and perinatal outcome but also future diabetes in both mother and child. Whatever method used it is important to do universal screening in Southeast Asians countries.

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DIABETIC FETOPATHY

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Introduction

Diabetes has been a dreadful disease for everyone, more so, for pregnant female, where due to physiological raised insulin resistance, glucose tolerance gets decreased, leading to more aggravated hyperglycemic situations. During pregnancy, fetus is dependent on mother for nutrition, who ultimately gets affected in case of gestational diabetes mellitus (GDM). There are various abnormalities a fetus can develop, from congenital malformations, Intra-uterine growth restrictions (IUGR), macrosomia or other organ/growth problems, and even stillbirth/Intra-uterine fetal death (IUFD).

The risk of congenital malformations in fetus increases with Maternal type 1 and 2 diabetes, including GDM.[1] Around 2 to 3 times increased incidence is seen in such cases, prevalence being approximately 4-8%. Malformations may affect various systems including Central nervous system (CNS), cardiovascular system (CVS), skeletal system, genito-urinary (G.U.T.) and gastro-intestinal system (GIT).[2]

Fetal macrosomia, in 3rd trimester is also a prominent feature of diabetic fetopathy. Birth weight is usually more than 4 kg. Shoulder dystocia, birth injuries and neonatal asphyxia are common occurrences in such cases, adding to maternal and perinatal morbidity and sometimes mortality.
Maternal euglycemia has to be the aim for prevention/alleviation of many of these complications.

Mechanism

In case of uncontrolled maternal hyperglycemia, increased glucose enters fetal circulation, leading to activation of hexosamine biosynthetic pathway, or hypoxia, leading to increased amount of oxidative stress in fetus.[3] As a result, there may be derangements at multiple levels ranging from gene expression to apoptosis and organ formations, thus causing malformations. There are several other theories including functional deficiencies of arachidonic acid and myoinositol, increased non-enzymatic

glycosylation of embryonic proteins, reduced catalase activity, and abnormal levels of trace metals.[4,5,6,7,8,9] As mentioned, there are many systems getting affected in this process, most frequently, CVS, CNS and G.U.T.. The rate of facial defects, femoral hypoplasia and caudal dysplasia, is also more in diabetic mothers as compared to euglycemic ones.[10]
Fetal macrosomia is result of fat deposition over abdominal, inter-scapular regions, in turn, increasing abdominal and shoulder circumference.

Diagnosis

Ultrasound (USG) and doppler studies are of utmost importance for monitoring intra-uterine development. Macrosomia assessment and any disproportion with the help of fetal biometry, phenotypic and visceral signs of diabetic fetopathy, assessment of amniotic fluid and placenta and its grading are to be monitored. Estimated fetal weight and abdominal circumference above 90th percentile by USG suggests fetal macrosomia. Clinical examination further can help by having increased fundal height in relation to gestational age, along with polyhydramnios.
Phenotypic signs include increased scapular width along with increased thickness of neck and abdominal subcutaneous tissue.

Visceral Signs include fetal hepatomegaly, cardiomegaly, cardiomyopathy and pancreatic enlargement. USG diagnosis of diabetic fetopathy is not possible before 16 weeks of gestation. One needs to be vigilant with regards to USG markers suggestive of fetopathy, which include, reduced head circumference/abdominal circumference ratio, neck thickening, thickening of head and abdominal subcutaneous tissue and cardiomegaly.
Congenital malformations and other complications

Congenital malformations:
GDM, uncontrolled, leads to variety of malformations. HbA1C less than <8.5%, has anomaly rate of only 3.4%; while poor glycemic control (HbA1C >8.5%) has shown anomaly rate of 22.4%.[11]
Caudal regression syndrome: Most common congenital anomaly found in infants of diabetic mothers. The condition involves partial agenesis of sacrum and in some cases, there may be complete absence of lumbo-sacral spine.[12]

Sacral agenesis and caudal regression syndrome are pathognomonic of diabetes, approximately 256 times more common in GDM patients.

Holoprosencephaly: Metabolic abnormalities of GDM leads to development of holoprosencephaly in around 1-2% of GDM cases, which is 200 times higher as compared to eu-glycemic patients.[13]

Neural tube defects: Spina bifida, hydrocephalus and other CNS defects are almost twice common in GDM patients, along with 3 fold rise in cases of anencephaly. Animal studies have shown involvement of Pax-3 gene leading to these defects.[14,15,16]

Congenital heart defects: Rate of its occurrence is 2.8 times higher in diabetic mothers as compared to healthy mothers.[12]

Other system involvement in form of hallucal polydactyly, anorectal atresia/stenosis, heterotaxy, thymus hypo/aplasia and multicystic dysplastic kidneys may occur in fetus of GDM pregnancies.

Early neonatal complications:
Transient hypoglycemia, polycythemia, hyperbilirubinemia, Respiratory distress syndrome (RDS) are known complications seen in post natal phase of neonate born of diabetic mothers. Transient hypertrophic cardiomyopathy with subaortic stenosis and congenital heart failure, are cardiac complications. In case of infants born of diabetic mothers, there is a lag period of around 3-4 weeks for achievement of pulmonary maturity. There may be hyperplasia of islet cells in pancreas, which may return to normal within first few days in neonatal period.

Histological Changes
GDM is associated with not-so-well defined complications, hazier would be histological changes of affected organs/tissues. Following changes have been recognised in autopsy of stillborn born of diabetic mothers:
Liver: generalised macro-vesicular steatosis, multiple small cysts
Pancreas: Langerhans islet hyperplasia, Langerhans amyloidosis, reflective of severity of GDM
Adrenal glands: zona glomerulosa cell hyperplasia, indicating fetal hypertension.
Hepatosteatosis usually starts developing at least after 8 weeks of exposure to increased glucose levels, which may be a contributing factor in development of insulin resistance.[17,18]

Pre-conceptional Prevention of diabetic embryopathy
The occurrence of congenital malformation usually starts before 7 weeks of gestation, so the remedy should aim at correcting any possible causes before that. Proper glycemic control can lead to significantly reduced incidence of congenital malformation. There have been several studies, one of them done by Fuhrmann et al concluded that incidence of congenital malformation was 0.8% in patients with intensive control over glucose levels in pre-conception period as compared to 7.5% in patients with strict metabolic control after 8 weeks of gestation.[19]

Prepregnancy counselling in form of explanation on diet, exercise and proper body mass index; risk of hypoglycemia, increased risk of macrosomia and birth injuries, increased risk of neonatal complications, along with importance of maintaining eu-glycemic status has to be done.

Conclusion

Untreated diabetes, thus leads to fetal-perinatal morbidity and mortality. Maternal glycemic control even before conception reduces fetal morbidity significantly. During pregnancy, along with maternal glucose level monitoring and control, it is need of this hour to develop more specific markers for diagnosis of fetal involvement as well as co-relation of levels of those markers between mother and neonate.

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TREATMENT OF GESTATIONAL DIABETES MELLITUS CAN THERE BE CLARITY FROM CONFUSION?

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Gestational diabetes mellitus (GDM) is the development of impairment in glucose tolerance with the first appearance or recognition during pregnancy. The rates in India are 10-14.3% in the year 2010. It is increasing tremendously with changes in the lifestyle of the population.

The screening methodology, diagnosis and treatment modalities of GDM is still controversial. Each part of the world is following different criteria. But it is universally accepted that GDM needs to be strictly controlled for a good maternal and fetal outcome.

The treatment options vary from medical nutrition therapy (MNT) to insulin and to oral hypoglycemic drugs. This article discusses the different treatment options for GDM by different guidelines.
Government of India guidelines[1]:

1. Once GDM is diagnosed, the mother is advised MNT. It consists of meals where carbohydrate intake is controlled. There is optimization of nutrition to meet the nutrition needs of the mother and the foetus. The plan includes energy appropriate for optimum weight gain and for maintenance of normal glucose level. An appropriate exercise regime is advised.
2. When on MNT, blood glucose 2 hours after a meal (PPBS) is checked after 15 days. If PPBS is maintained at less than 120mg/dl, she is asked to continue on MNT and exercise.
3. If the PPBS is not maintained at <120mg/dl and she is less than 20 weeks pregnant, insulin therapy is started. When on insulin therapy, blood sugar is monitored every third day or frequently. The target levels are fasting blood glucose (FBS) less than 95 and PPBS less than 120mg/dl.
4. If the woman is more than 20 weeks gestation and her PPBS is more than 120mg/dl, she is started on metformin. When on metformin, blood sugars are tested twice in a week.
5. Metformin is started at 500m/day twice daily and is increased up to 2 gm/day until blood sugar control is obtained. The advantages of metformin over insulin is the reduced maternal weight gain and incidences of hypoglycemia.
6. If blood sugar target levels are not obtained with metformin, injection insulin is added.
7. If the two- hour PPBS is very high at the initial diagnosis of GDM, Insulin is started at once.

NICE Guidelines[2]:

1. According to the NICE Guidelines, GDM is diagnosed when there is a fasting plasma glucose level of 5.6mmol/L or a 2-hour plasma glucose level of 7.8mmol/L.
2. Once the diagnosis of GDM is made, the patient is advised diet therapy and exercise. The patient is reviewed after 1-2 weeks.
3. If the target levels are not met, oral metformin or insulin therapy is initiated.
4. Insulin is started at once if there is a contraindication or if the patient is not interested in metformin therapy. If target levels are not attained on metformin therapy, insulin is added.
5. Glyburide is initiated if there is intolerance to metformin or the patient refuses insulin therapy and is not controlled on metformin therapy.
6. Immediate initiation of insulin therapy:
   a. If fasting glucose level is more than 7.0mmol/L at diagnosis
   b. If fasting glucose level is between 6.0 and 6.9mmol/L and there is macrosomia or hydramnios

American College of Obstetricians and Gynaecologists (ACOG) Guidelines[3]: (2013)
Once a diagnosis of GDM is made, the patient is advised nutrition therapy. If target levels are not achieved, insulin therapy is initiated. Glyburide or metformin can also be tried as first line therapy.

American Diabetes Association (ADA) Guidelines[4,5]: (2016b)
Insulin is to be considered as first line drug therapy in GDM. Glyburide is associated with an increased risk of macrosomia and neonatal hypo glycemia. Metformin can be tried in GDM but has a higher risk of prematurity and the unknown long-term effects on the foetus is of concern. Metformin crosses the placenta.

In the metformin in GDM trial (MiG)[6] of 2008, metformin is compared with insulin in the treatment of GDM. There is no great difference between the therapies with respect to the neonatal outcomes. Preterm deliveries and the risk of severe neonatal hypo glycemia is found more in the metformin group. 45% of women in the metformin group needed additional insulin therapy for glycemic control. In the study by Moore et al in 2010[7], metformin and glyburide therapies are compared. In this study, the patients on metformin required additional insulin for blood sugar control. A comparative study on metformin therapy versus insulin has been conducted by Balsells in 2015[8]. In this study, metformin therapy is associated with lesser maternal weight gain and lesser risk of pregnancy induced hypertension. But the foetal effects are increased preterm deliveries, lower age of the foetus at delivery and decreased incidence of neonatal hypo glycemia with metformin usage. Supplemental insulin for glucose control is needed in 33.8% of the patients.

Conclusion:
Insulin therapy is considered as the best therapy for the glycemic control in patients with GDM. As it is expensive and needs motivation by the patient, the oral hypoglycemic drugs like glyburide and metformin are tried as therapy. Both the oral drugs when used may need additional insulin therapy for optimum control. Metformin is used with caution as it crosses the placenta and the long-term effects on the foetus are not clear. Glyburide is associated with a higher chance of neonatal hypo glycemia. Both the oral drugs are less effective if the fasting blood glucose levels are high at diagnosis or if GDM is diagnosed before 26 weeks of pregnancy. The above factors need to be considered before the initiation of therapy in patients with GDM.

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QUIZ

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1. Infants of diabetic mother are likely to have the following cardiac anomaly:
a. Coarctation of aorta
b. Fallot's tetrology
c. Ebstein's anomaly
d. Transposition of great arteries

2.Ideal time to do glucose challenge test in pregnancy is:
a. 12–16 weeks
b. 20–24 weeks
c. 24–28 weeks
d. 30–34 weeks

3. DIPSI recommends _____ gms oral glucose load
a.75
b.50
c.100
d.150

Answers

1. Answer: d (Transposition of great arteries)
Explanation:
Incidence of major congenital malformation in children of diabetic mothers is 5–10%, and most common defects are cardiac defects (VSD, transposition of great vessels) followed by NTDs.
Caudal regression syndrome/sacral agenesis is a defect most specifi c to diabetic embryopathy.
Hyperglycemia probably increases the development of free oxygen radicals and interferes with arachidonic acid metabolism, which are responsible for embryopathy.

2. Answer: c (24–28 weeks)
Explanation:
Pregnancy is a diabetogenic state because of:
1. Insulin resistance
Production of HPL
Increased production of cortisol, estrogen, and progesterone
Increased destruction of insulin by kidneys and placenta
2. Increased lipolysis
3. Altered gluconeogenesis
O'Sullivan Blood Sugar Screening Test (Glucose Challenge Test)
The ideal time to do this test is 24–28 weeks of gestation (as insulin resistance in pregnancy is maximum at 28 weeks of gestation).
50 g glucose is given irrespective of the period of fasting and plasma glucose is measured after 1 hour. If it is >140 mg/dL, it is an indication for further testing (do GTT).

3. Answer – a. 75 g
The Diabetes In Pregnancy Study group India (DIPSI) reported practice guidelines for GDM in the Indian environment. Due to high prevalence, screening is essential for all Indian pregnant women. DIPSI recommends that as a pregnant woman walks into the antenatal clinic in the fasting state, she has to be given a 75 g oral glucose load and at 2 hrs a venous blood sample is collected for estimating plasma glucose. This one step procedure of challenging women with 75 g glucose and diagnosing GDM is simple, economical and feasible. Screening is recommended between 24 and 28 weeks of gestation. If 2 hours plasma glucose is ≥ 140 mg/dL, then it is considered to be a case of GDM