Screening, diagnosis and management of gestational diabetes mellitus: A national survey

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Abstract

Background and methods: We conducted a National survey between February and June 2012 to evaluate the practices concerning screening, diagnosis and management of Gestational Diabetes (GDM) in England.

Results: A total of 102/126 (80%) maternity units responded. The National Institute of Health and Clinical Excellence (NICE) recommended screening criteria were used by 83% of units. All the units performed 2 h 75 g oral glucose tolerance test (OGTT) between 24 and 28 weeks. There was a wide variation in the diagnostic blood glucose values used by different units. About 86% of units used a 2 h blood glucose value of ≥ 7.8 mmol/l and 45% of units used fasting value ≥ 6.1 mmol/l to diagnose GDM. Only 26% of units advised self-monitoring of blood glucose pre meal and 1 h post-meal, whereas 64% of units advised monitoring 2 h after the meal. Metformin was started when women did not respond to dietary measures in 101 units (99%). Regular growth scans every four weeks from 28 weeks onwards were performed by 99 units (97%). Women on metformin with no complications were offered induction of labour at 38 completed weeks in 97 units (95%). 84 maternity units (82.3%) offered OGTT six weeks postnatally.

Conclusion: Our survey has shown consistency in screening using the NICE criteria, use of 2 h 75 g OGTT at 24–28 weeks, in providing dietary support, use of metformin and ultrasound for fetal growth. But there is wide variation in the criteria used to diagnose GDM, self-monitoring of blood glucose, induction of labour and six weeks postnatal testing.

Keywords

Pregnancy, diabetes, gestational diabetes, survey

Introduction

Gestational diabetes (GDM) is defined by the World Health Organization (WHO) as ‘carbohydrate intolerance resulting in hyperglycaemia of variable severity with onset or first recognition during pregnancy’.¹ Maternal hyperglycaemia results in fetal hyperglycaemia thereby leading to shoulder dystocia, birth trauma, perinatal death, neonatal hypoglycaemia and long-term risk of obesity and diabetes in the child. The maternal risks include subsequent development of type 2 diabetes mellitus. The potential benefits of recognising and treating GDM include reductions in ill health in the woman and/or the baby during or immediately after pregnancy, as well as the benefits of reducing the risk of progression to type 2 diabetes in the longer term and/or future pregnancies being complicated by pre-existing or GDM.²

A national survey on GDM screening and glycemic management conducted on behalf of the Association of British Clinical Diabetologists in 2008 concluded that the standards for GDM management varied significantly across the UK.³ They recommended the urgent need for consensus guideline development.

In July 2008, the National Institute of Health and Clinical Excellence (NICE) published guidelines on ‘Diabetes in Pregnancy’.⁴ NICE recommends the use of a 2 h, 75 g oral glucose tolerance test (OGTT) and the diagnostic levels comprising fasting venous plasma glucose ≥ 7 mmol/l or a 2 h ≥ 7.8 mmol/l. Subsequently, the Hyperglycaemia and Adverse Pregnancy Outcome (HAPO) study⁵ was published in 2008, which showed that there was a continuum of risk with no threshold which could divide women into those with GDM and those without. There was a linear relationship between plasma glucose and adverse outcomes. The results of this large observational study form the basis of the recommendation for diagnosis and screening for diabetes in a consensus report published in 2010 by the International Association of Diabetes and Pregnancy Study Group (IADPSG).⁶ The IADPSG consensus recommends a one step 75 g OGTT for all women not already known to be diabetic at 24–28 weeks of gestation and diabetes is diagnosed where one or more threshold value is exceeded (fasting ≥ 5.1 mmol/l, 1 h ≥ 10.0 mmol/l,

2 h ≥ 8.5 mmol/l). Moreover, the two large randomised controlled trials, the Australian Carbohydrate Intolerance study in pregnant women (ACHOIS)⁷ and the Maternal Fetal Medicines Unit Network (MFMUN)⁸ concluded that the treatment of glucose intolerance improves outcomes. Following this new evidence, the Royal College of Obstetricians and Gynaecologists (RCOG) scientific committee⁹ recommended that there is an urgent need for health economic modelling to assess the cost of adoption of the international consensus in the UK. The most recent Scottish Intercollegiate Guidelines Network (SIGN) guidelines on the management of diabetes¹⁰ published in 2010 advocated 75 g OGTT to high risk women and the diagnostic levels suggested by IADPSG. In view of the important advances since the publication of NICE guidance, we planned to conduct a national survey to evaluate the practices concerning screening, diagnostic cut-off values and management of GDM in England.

Methodology

A questionnaire (Appendix 1) was designed based on the NICE guidelines on ‘Diabetes in Pregnancy’⁴ to collect the following data:

1. Screening criteria: Universal or risk factor based screening recommended by NICE (BMI > 30 kg/m², previous macrosomic baby

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weighing ≥ 4.5 kg, previous GDM, family history of diabetes and family origin with high prevalence of diabetes).

2. Diagnostic test: Type of OGTT used – 75 g/100 g OGTT or if any other test used.
3. Diagnostic criteria for GDM: Blood glucose cut-off values used.
4. Management of GDM: Antenatal follow-up, home blood glucose monitoring, use of oral hypoglycaemic agents/insulin, monitoring of the fetus and induction of labour.
5. Postnatal follow-up: Postnatal OGTT or fasting blood sugar and further follow-up.

All maternity units in England that provided care for women with GDM were contacted by telephone for data collection. The questionnaire was emailed to the Diabetes Specialist Midwife (DSM) or Diabetes Specialist Nurse (DSN) if they were busy and unable to provide information over the telephone. The data collection was undertaken between February 2012 and June 2012. The list of all Maternity units in England was compiled from NHS choices website and also from the Royal College of Obstetricians and Gynaecologists, London which holds details of all maternity units in UK.

Data analysis

The data were collected on an excel spreadsheet. The results were analysed and manually checked again to confirm the results.

Results

A total of 126 maternity units in England were contacted of which 102 (81%) responded to the questionnaire. This included both District General and University Hospitals.

Screening criteria

Out of 102 units that responded, 92 (90%) used risk factors for screening. NICE recommended screening criteria were used by 85 units (83%) but seven (7%) units included other criteria such as polycystic ovarian syndrome (PCOS), glycosuria and BMI >35 . Universal screening was used in 10 (10%) units.

Diagnostic tests

All the units performed 2 h 75 g OGTT between 24 and 28 weeks as recommended by NICE guidelines. Lucozade was used in 70 units (68.6%), 25 units (24.5%) used polycal and 7 units (7%) used glucose solution prepared by their pharmacy. In women with previous GDM, 84 units (82.3%) performed 75 g OGTT at 16–18 weeks of gestation. Home blood glucose monitoring (HBGM) at booking was used in 16 units (17.6%) and the remaining 2 units (2%) used HbA1C at booking. Eighty-five units (83%) performed OGTT in the hospital and 16 (18%) units used both the hospital and community settings. One unit performed OGTT only in the community setting.

Diagnostic criteria

There was a wide variation in the diagnostic blood glucose values used by different units as reported in Table 1.

Management of GDM

All the units offered referral to a dietician once women had an abnormal OGTT result. Group therapy was offered in five units

Table 1. Diagnostic criteria (75 g OGTT cut-off values).

Fasting blood glucose (mmol/l)	n = 102 units	2 h blood glucose (mmol/l)	n = 102 units
≥ 5.0	1	≥ 7.5	1
≥ 5.1	3	≥ 7.7	2
5.3	3	≥ 7.8	88
5.5	4	≥ 7.9	2
5.6	4	≥ 8.1	3
5.8	4	≥ 8.5	5
≥ 6.0	30	≥ 9.0	1
≥ 6.1	45		
≥ 7	2		
≥ 7.1	2		
No fasting glucose	4		

and in seven units women were seen by DSM along with the dietician. Oral hypoglycaemic agents were started when women did not respond to dietary measures in 101 units (99%). One unit offered metformin with dietary management soon after diagnosis of GDM. In 11 units (10.8%), if the booking BMI was greater than 35 kg/m², they were commenced on diet and metformin after an abnormal OGTT results.

Insulin was commenced directly if OGTT 2 h value was more than 11 mmol/l by 12 units. The diabetologists and DSN commenced women on insulin in 99 units, whereas insulin was commenced in three units by the DSM.

Self-monitoring of blood glucose

In all units, the women with abnormal OGTT were seen within 1–2 weeks following the result. About 47 units (46%) advised women to self-monitor the blood glucoses seven times a day (pre-meal, 2 h post-meal and bed time). Thirty-one units monitored six times a day (pre-meal and post-meal being after 1 in 12 units and 2 h in 19 units). Nineteen units monitored four times a day (fasting and 1–2 h post-meal, 14 units used 1 and 5 units used 2 h post-meal) and 4 units only twice a day (1 h post-meal).

Monitoring fetal growth

Regular growth scans, every four weeks from 28 weeks onwards, were offered by 99 units (97%). Three units used clinical assessment to guide the need for ultrasound assessment.

Induction of labour

In women with diet controlled GDM with no complications like macrosomia, and well-controlled glycaemia, 88 units offered induction of labour (IOL) at or after 40 weeks of gestation. Only 14 (14%) units offered routine IOL after 38 completed weeks. For women on metformin and no complications, 97 units (95%) offered IOL at 38 completed weeks and 4 units offered IOL at or after 40 weeks. When women were on insulin with well-controlled GDM with no macrosomia, all 102 units offered IOL at 38 completed weeks.

Postnatal care

A total of 84 maternity units (82.3%) offered OGTT six weeks postnatally and only 16 units (15.7%) offered six weeks postnatal fasting plasma glucose measurement. One unit offered HbA1C in the postnatal period. A letter was sent to the general practitioner (GP) for annual follow-up with fasting blood glucose by all units. In 54 units (52.9%), the diabetic team reviewed the patients with abnormal postnatal OGTT. In 56 units (54.9%), GP followed them up and referred to diabetic team if required. In two units, patients were followed up in the general postnatal clinic and referred to the diabetic team.

Discussion

Our study has evaluated the practice in screening and management of GDM in 102 obstetric units in England. The data were gathered via telephone from the DSN or the DSM. These were assessed against the NICE guidelines on 'Diabetes in Pregnancy' published in July 2008.⁴ Our results show that the majority of the units were following the NICE guidelines for screening and management of women with GDM; however, the practice is still varied throughout the country.

Our study showed that all units in England offered routine screening for GDM, with 83% adopting risk factor based screening recommended by NICE. In a survey by Hanna et al. in 2008,³ routine screening for GDM was provided only by 82% of centres in the UK with 52% adopting universal screening and 11% screening based on high risk features. If screening was positive, a 2 h 75 g OGTT was performed by all the units between 24 and 28 weeks gestation in our survey, but only by 65% of units in the survey by Hannah et al.³

Our survey also showed a wide variation in the blood glucose values used to diagnose GDM, although majority of the units used a fasting value of ≥ 6.1 mmol/l (45%) and a 2 h cut-off value of ≥ 7.8 mmol/l (86%). Only a small proportion of the units (4%) used a fasting cut-off value of ≥ 7 mmol/l as recommended by NICE. On the other hand, the majority adhered to the NICE 2 h cut-off value of ≥ 7.8 mmol/l (86%). About 5% of the units used fasting (≥ 5.1 mmol/l) and 2 h (≥ 8.5 mmol/l) IADPSG criteria. Internationally, there are several different criteria for the diagnosis of GDM (WHO, O'Sullivan and Mahan, National Diabetes Data Group and Carpenter Coustan). NICE⁴ identified four studies^{11–14} which found that women with levels of glucose above normal (≥ 7.8 mmol/l) but below the threshold value for GDM defined by NDDG (≥ 9.1 mmol/l) or Carpenter and Coustan Criteria (≥ 8.6 mmol/l) have significantly higher risks of adverse maternal and neonatal outcomes. This formed the basis for adopting 2 h 75 g OGTT using WHO criteria as the diagnostic test for GDM. WHO definition of GDM encompasses both impaired glucose tolerance (IGT) (fasting blood glucose (FBG) < 7.0 mmol/l and 2 h blood glucose 7.8 mmol/l or more) and diabetes (FBG 7.0 mmol/l or more or a 2 h blood glucose 11.1 mmol/l or more). This definition was not clear about inclusion of impaired fasting glycaemia (fasting blood glucose ≥ 6.1 mmol/l) and whether one or both values from OGTT must be equated or exceed for diagnosis of GDM using the WHO IGT criteria. Moreover, there was no study identified by NICE which showed a correlation between fasting hyperglycaemia and adverse maternal and neonatal outcomes. Fasting glucose diagnostic values used by WHO (≥ 7.0 mmol/l), NDDG (≥ 5.8 mmol/l), Carpenter and Coustan (≥ 5.3 mmol/l) and O'Sullivan (≥ 5.0 mmol/l) were widely variable. This could probably explain the reason for wide variation in the fasting blood glucose values used by different units in our study. Evidence from HAPO⁵ showed a linear relationship between maternal fasting plasma glucose and OGTT at 1 h and 2 h with birth weight above 90th percentile. There was no threshold effect in the HAPO data.

NICE recommendations for self-monitoring of blood glucose during pregnancy are to test fasting blood glucose levels and 1 h after every meal. The evidence for this recommendation for GDM is based on a single RCT¹⁵ of 66 women with GDM who required insulin. This study showed fasting and 1 h post-meal monitoring to be

associated with a significantly lower risk of macrosomia, lower caesarean section rates and shoulder dystocia when compared to fasting and pre-meal monitoring. Our survey showed that 64% of units advised women to test blood glucose 2 h after the meal with wide variation in the frequency of monitoring. Blood glucose monitoring frequency varied between two and seven times a day with 76% of units monitoring between six and seven times a day.

NICE recommended that hypoglycaemic therapy for women with GDM may include regular insulin and/or oral hypoglycaemic agents [metformin and glibenclamide]. There was no specific recommendation about the type of oral hypoglycaemic agent to be used. Moreover, 99% of the units in our survey used metformin. Although two randomised trials of glibenclamide versus insulin were included in NICE, the MIG (Metformin in Gestational Diabetes Trial) was published following the publication of NICE Diabetes in pregnancy guideline in 2008. MIG trial concluded that metformin is not associated with increased perinatal complications and reported high patient satisfaction compared to insulin. The evidence from the large MIG Trial²⁰ could be the reason why 99% of the units in England used metformin as first line oral hypoglycaemic agent.

NICE recommends offering ultrasound monitoring of fetal growth and amniotic fluid volume at 28, 32 and 36 weeks. Our survey showed that 97% of the units performed an ultrasound assessment of fetal growth and amniotic fluid volume, and 95% of units in the survey by Hanna et al. performed growth scans.

NICE recommends offering induction of labour to women with diabetes who have a normally grown fetus at 38 weeks of gestation. The evidence for this recommendation is based on single RCT¹⁶ of 200 women (GDM $n = 187$ and pre-existing diabetes $n = 13$) with insulin-requiring diabetes. This study confirmed that birth after 38 weeks was associated with increased risk of caesarean section, large for gestational age (LGA) and shoulder dystocia. Our survey showed that induction of labour at 38 completed weeks was offered by 14% of units for women managed by diet only, 95% of the units for women on metformin and by all units for women on insulin. There is no evidence in the literature about the timing of delivery in women managed by diet and/or metformin and also those with mild GDM (2 h OGTT ≥ 7.8 mmol/l to 11.0 mmol/l) as the above RCT included women with overt GDM.

NICE recommends that lifestyle advice and fasting plasma glucose measurement should be offered at six weeks postnatal check and annually thereafter. The evidence for this recommendation is based on a retrospective study¹⁷ which showed fasting plasma glucose of 6.0 mmol/l to have sensitivity of 100% and specificity of 94% for identifying those with diabetes compared to OGTT. However, this study does not report the sensitivity and specificity of fasting plasma glucose in identifying impaired glucose tolerance. Mc Lean et al. showed that¹⁸ a postpartum fasting plasma glucose measurement alone is not sensitive enough to classify glucose tolerance status accurately. Our survey showed 82% of units offered OGTT at six weeks postnatal period.

The strength of our study was a very good response rate of 80%, including both Teaching and District General Hospitals. However, the survey involved only England, which may not represent the practice in the whole of UK. We were unable to identify from our literature search any other study reporting the audit of practice in Scotland and Wales. The other limitation of our study is that we surveyed DSMs and DNSs who provided the information required for our audit. DSM and DSN are highly specialised and were able to provide the information about the management of women with GDM according to their departmental policy, but not individual clinicians' practice.

In conclusion, our National Survey has shown a significant improvement in screening using the NICE criteria, use of 2 h 75 g OGTT at 24–28 weeks, provision of dietary support, use of metformin, fetal monitoring and induction of labour compared to the previous survey.³ This had concluded that the introduction of NICE guidelines should establish a more 'unified' approach for screening and management of GDM. However, our survey showed a wide variation in the diagnostic criteria used to diagnose GDM, self-monitoring of blood glucose, induction of labour and six weeks postnatal testing.

Despite advances in knowledge following the ACHOIS⁷ and HAPO⁵ studies, some key uncertainties regarding screening and diagnostic criteria for GDM remain, which could be the reason for differences in practice identified by our survey. The Health Technology Assessment 2010¹⁹ recommended that these could be resolved by further analysis of already collected HAPO data and also by updated modelling using the UK model used in developing the NICE guidelines for each of the seven HAPO categories. They also concluded that uncertainty about the level at which intervention is justified may come out of this recommended modelling.

The NICE guideline is currently being updated and the expected publication date of the updated guideline is June 2014. Further National audit following publication of updated NICE guideline is recommended.

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Declaration of conflicting interests

The authors declare that there is no conflict of interest.

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Contributorship

PM conceived the idea, designed the study and wrote the manuscript. SSu collected and analysed the data and contributed to the drafts. RB, SSo and TF contributed to the final draft.

Ethical approval

Not required.

Guarantor

PM.

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Appendix I

- Screening for GDM
 - Universal screening
 - High risk women – Follow NICE recommendations
 - Other
- If previous GDM
 - GTT – when do you screen?
 - HbGM
- Time of screening
 - 24–26 weeks
 - 26–28 weeks
 - Other

- (d) Screening using
3. Fasting blood glucose
 4. Random blood glucose
 5. Glucose challenge test
 6. 2 h 100 g OGTT
 7. 3 h 100 g OGTT
 8. 2 h 75 g OGTT
 9. If different from above please state
 10. What do you use for GTT?
- (e) Place of screening – community/Hospital
- (f) Which diagnostic criteria
1. fasting ≥ 5.1
 2. 2 h ≥ 8.5
 3. fasting ≥ 6.1
 4. 2 h ≥ 7.8
 5. If different from above please state
- (g) If GTT positive, are the patients started on
1. Diet – leaflet/group sessions/dietician
 2. Metformin – When do you start?
Criteria for starting
 3. Insulin – Criteria for starting
Type of insulin
Staff starting insulin – DSN/DSM/Physician
- (h) BM monitoring:
- Seven times
 - Pre-meals only
 - Post-meals only – 1 h/2 h
 - Fasting and post-meal 1 h/2 h
- (i) AN Visits
- When do the visits start?
 - Where are the patients seen – ANC by DSM/DSN/Consultant obstetrician/Consultant diabetologist
 - No. of visits
- (j) Growth scans
1. 28
 2. 32
 3. 36
 4. No routine ultrasound, only clinical examination, and ultrasound if required
- (k) Induction of labour for metformin treated patients with no other complications (no macrosomia, good sugar control and no obstetric complication)
- At 38–39 weeks/at 40 weeks/at 41 weeks/at 42 weeks.
- (l) IOL for Insulin treated patients with no other complications (no macrosomia, good sugar control and no obstetric complication)
- At 38–39 weeks/at 40 weeks/at 41 weeks/at 42 weeks
- (m) IOL for patients on diet only with no other complications (no macrosomia, good sugar control and no obstetric complication)
- At 38–39 weeks/at 40 weeks/at 41 weeks/at 42 weeks
- (n) Postnatal GTT
- At six weeks
 - At six months
 - Where do the patients have GTT – Hospital
Community
- (o) If monitoring by Fasting blood glucose when?
- (p) Postnatal follow-up
- Do you routinely see them postnatally, if yes
 - Is it in PN clinic, who will r/v?
 - Do the GP follow them up.
 - Review only if postnatal GTT is abnormal
 - If plan for annual BM
 - How do you communicate with the GP?