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Gestational diabetes screening and glycaemic management; National survey on behalf of the Association of British Clinical Diabetologists

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Summary

Background: There is no UK consensus for screening methodology, diagnosis and management of gestational diabetes mellitus (GDM).

Aim: To evaluate routine practice for GDM management across the UK.

Methods: Questionnaires were sent to all members of the Association of British Clinical Diabetologists. They were asked to describe how patients were screened for GDM, the diagnostic criteria and subsequent management and clinical targets. Centres that did not respond were followed up by personal communication. Variability trends within regions were assessed.

Results: The response rate averaged 46% nationally (35–67%). Most (85%) units hold a joint clinic, regardless of the size. Most (82%) centres routinely screen for GDM; half universally and half screening high risk pregnancies only. Screening tests, cut-off values, timings and subsequent action vary widely. The first screening test to be used varies, with 40%

using glycosuria, followed by random plasma glucose (RPG)(28%), high risk features (11%) then FPG in 6%. Cut-off values for both random and plasma glucose as screening methods also vary. The 75 g oral glucose tolerance test (OGTT) is the most likely confirmatory test to be used if initial screening is positive; however, clinicians rely on different cut-off values and timing. Most (95%) centres routinely assess foetal growth. Postpartum screening is undertaken by 90%, using a 75 g OGTT (93%). Most (90%) centres counsel patients about their high risk for further GDM and type 2 diabetes mellitus. Variability trends in any of the responses could not be detected between different regions in the UK.

Conclusion: Standards for GDM screening and management vary significantly across the UK. Although most centres utilize the 75 g OGTT to confirm the diagnosis, there is no consistency in its interpretation. This survey confirms the urgent need for consensus guideline development.

Introduction

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance, resulting in hyperglycaemia of variable severity, with onset or first recognition

during pregnancy. Unlike established diabetes antedating the onset of pregnancy, GDM is usually not established until the late second trimester and,

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therefore is not associated with increased malformation rate. However, similar to pre-gestational diabetes, the raised maternal glucose and amino acid levels can induce foetal hyperinsulinaemia and macrosomia with its consequences (including shoulder dystocia, birth injuries and neonatal hypoglycaemia), respiratory distress syndrome, polycythaemia and hypocalcaemia. The long-term adverse outcomes include high maternal risk for subsequent development of diabetes.^{1,2} Infants born to mothers with GDM are at higher risk to develop impaired glucose tolerance and later diabetes.³ The impact of glycaemic abnormalities and their effect on future risk of diabetes was proposed in the 'thrifty phenotype' hypothesis⁴ whereby low birth weight, due to growth retardation, predicted type 2 diabetes. Paradoxically, larger babies of diabetic mothers are also at higher risk of developing diabetes, regardless of their genetic susceptibility.⁵ This led to the concept that intrauterine experiences 'programme' foetal systems and influences future health.⁶

Despite the documented intra partum risks, the uncertainty surrounding outcomes of intervention in GDM has resulted in long standing lack of consensus.^{7,8}

Currently, in the USA, the American Diabetes Association (ADA) has an agreed pro-screening policy with risk stratification followed by a 50 g, 1 h oral glucose tolerance test (OGTT) for screening, then by a 100 g, 3 h OGTT for confirmation. Most recently, a 2 h 75 g OGTT has also been endorsed within the ADA, with the same fasting, 1 and 2 h cut points used in the 3 h, 100 g OGTT.⁹

The World Health Organisation (WHO) supports the use of a 2 h, 75 g OGTT, with different cut-off points from the ADA (fasting ≥ 7 and 2 h ≥ 7.8). The test is to be arranged in the first trimester for those at risk of GDM, otherwise, it is recommended between 24- and 28-week gestations.¹⁰ The Diabetes Pregnancy Group of the European Association for the study of diabetes has recommended reduction of the upper limit of normal of the fasting venous plasma glucose to 6 mmol/l, as more representative of the physiological changes in pregnancy.¹¹

In the UK, however, the lack of consensus prevails, resulting in a wide variability in screening practice for GDM within obstetric units, and a call for National guidelines.¹²

The wider context is of an increasingly multi-disciplinary approach to ante natal care, together with the accumulating evidence for rising prevalence of gestational diabetes,¹³ the confirmed long-term impact of hyperglycaemia on foetal risks¹⁴ and the awareness of potential for prevention of subsequent type 2 diabetes mellitus.^{15,16} It appeared timely therefore to appraise current practice in the

diagnosis and management of GDM within the UK by conducting a survey on behalf of the Association of British Clinical Diabetologists (ABCD).

The presentation of the results of that National survey is appropriate, in view of the recently published results of the Australian Carbohydrate Intolerance Study in Pregnant women Trial group (ACHOIS) trial,¹⁷ which confirms the foetal and maternal benefits of actively treating GDM, and the publication of the Confidential Enquiry into Maternal and Child Health (CEMACH) report on diabetes and pregnancy^{18,19} and its recommendations.

On behalf of the ABCD, we aimed to evaluate the current National practice, seeking to record in more detail the screening policies including the screening tests, their sequence as well as their cut-off values, timing as well as subsequent action if positive.

Methods

Questionnaire development and circulation

A questionnaire (Appendix 1) was designed (FWFH & JRP) to capture the following:

- (i) Centre details: Locality, presence of a joint diabetes antenatal clinic, number of deliveries per annum and the prevalence of GDM.
- (ii) Screening strategy for GDM, including: whether there was a routine screen (if not, what was the reason), if routine screening is in place was it selective (i.e. focused on women with high risk features) or universal.
- (iii) Screening tests for GDM, including which test(s) (random or FPG, glycosuria, high risk features, glycosylated haemoglobin or glucose tolerance test), timing (gestational age) of the test(s), cut-off values (for random and fasting glucose) and subsequent action if screening test were positive. Centres were also asked about the sequence of testing adopted to establish the diagnosis of GDM.
- (iv) Management of GDM, including the presence of guidelines to initiate insulin therapy, biochemical surrogates for insulin adjustment and whether foetal screening is routinely included in the management plan.
- (v) Postpartum management, including screening test, counselling women about their future risk for GDM and/or type 2 diabetes mellitus.

Circulation

The questionnaire design was discussed with consultant members of the Welsh Endocrine and Diabetes Society, to gauge views and feedback, and then subsequently with the Association of British Clinical Diabetologists and Diabetes, UK. The

ABCD agreed for the survey to be enclosed with their mailing shot to the ABCD members, in early 2003. The initial response rate was <30%. Centres that did not respond were contacted individually (as per Binley's Diabetes Handbook which includes all Trusts within the UK), re-faxing the questionnaire, to enhance the response rate and ensure adequate representation from various regions of the UK. The hospitals that responded included both district general and university hospitals throughout the UK.

Data analysis

The returned questionnaires were validated then scanned and transformed through 'Teleform' into SPSS database. Regional variability was assessed by subdividing the UK into 10 regions (South East and South West, London, Eastern, West Midlands, Trent, North West, Northern and Yorkshire, Scotland, Northern Ireland and Wales) then analyzing the data with the chi square test using StatXact 4 (Cambridge Mass.) which has the ability to evaluate associations in two way tables where there are small frequencies. We chose the most commonly reported response vs. others 'pooled' responses, e.g. checking RPG as a screening test at 24–28 weeks vs. other responses. In addition to giving an indication of trend in the variability in practice across the UK, comparison of responses from individual regions also provided an indirect validation of representation, given the low response rate.

Results

The response rate averaged 46% nationally (range of regional response rate was 35–67%). A total of 169 Trusts responded, all of which provide medical obstetric care. The non responders included those centres that did not provide the service, as well as these referring their patients to centres not responding despite subsequent contact. Most of the questionnaires were completed by Diabetologists 79% (130/164), with 19% (31/164) by nurse/midwife staff and 2% (3/164) by Obstetricians. Most 85% (140/164) units had a joint 'Diabetes and Pregnancy' clinic, regardless of the total number of deliveries per annum (range 480–6000, median 3000).

The reported prevalence of gestational diabetes varied widely from 0.1% to 10% (Median 1.5%).

Screening strategy

Routine screening was provided by 82% (130/158) of centres, with 52% (61/117) adopting universal screening and 48% (56/117) targeting high risk pregnancies only. Eighteen percent (28/158)

reported that they do not routinely screen for GDM with the following justifications; Lack of consensus 67% (16/28), No indication 8% (2/28), Operational obstacles 25% (6/28).

Screening tests (Table 1)

Table 1 summarizes the data, including the overall utilization of a specific test, the likelihood of its use as the first screen, timings, cut-off values and subsequent action if positive. Given the broad range of the received cut-off values, data were grouped into above 6, 5.6–6 mmol/l (and 5–5.5 mmol/l for FPG). Most centres relied on glycosuria and RPG as their first screen for GDM (54 and 52%, respectively), followed by 'High Risk features' (34%) then FPG (27%).

There was no evidence for regional variability trends for the screening tests including their timing, cut-off values (if applicable) as well as subsequent action if positive, indicating that there was no significant variability in practice within different regions of the UK.

Again, there was no significant regional variability in the utilization of a specific screening test as the first or subsequent screening test for GDM.

The 75 g OGTT

When first screening test is positive, most centres resort to 75 g OGTT (76, 74, 55 and 73% after initial screen with RPG, FPG, glycosuria and assessment of high risk features, respectively, Table 1). However, there was a wide variation in the timing and the cut-off values adopted by various centres (Table 2).

Management of gestational diabetes

Insulin therapy initiation

Whilst most 89% (151/169) of responding centres reported having guidelines for initiating insulin therapy, different centres used different surrogates, including fasting, random, 1 or 2 h glucose/BM values. Given the broad range of the received cut-off values, for analytical purpose, data were grouped as follows: random \leq or >8 mmol/l, fasting \leq or >6 mmol/l, 1 and 2 h postprandial \leq or >8 mmol/l. There was no evidence for regional variability trends in the insulin therapy practice.

Foetal monitoring

Almost all 95% (146/154) centres routinely arranged foetal growth scans, with no significant regional variability observed.

Table 1 Screening tests for gestational diabetes

	RPG	FPG	Glycosuria	High risk features	75 g OGTT
Use (<i>n</i> = 169) (%)	52% (88/169)**	27% (45/169)	54% (92/169)	34% (57/169)	76% (128/169)
Timing ^a week gestation					
24–28 week	48.3% (<i>n</i> = 76)	54% (<i>n</i> = 31)	–	55% (<i>n</i> = 40)	64.6% (<i>n</i> = 99)
<24 week	23.6	17.2%	11.7% (<i>n</i> = 76)	5%	11%
>28 week	9.1	19.4%	–	–	10.1%
Booking	20.8	6.5%	6.5%	25%	–
Others	If glycosuria (5.2%) Each visit (1.3%) Each trimester (1.3%)	If glycosuria or big baby (6.5%)	Each visit (84.9%)	Previous baby >4 Kg (2.5%) Each week (2.5%) When pregnancy confirmed (2.5%)	Anytime (5%) Following positive screen (16%)
Cut-off values	>6 mmol/l: 67% (<i>n</i> = 76) 5.6–6 mmol/l: 14% (<i>n</i> = 76)	>6 mmol/l: 40% (<i>n</i> = 40) 5.6–6 mmol/l: 30% (<i>n</i> = 40) 5–5.5 mmol/l: 18% (<i>n</i> = 40)			Variable (see below)
Further action, if positive screen	OGTT: 76% (<i>n</i> = 71) Diet/HBGM: 9% (<i>n</i> = 71) FPG: 9% (<i>n</i> = 71)	OGTT: 74% (<i>n</i> = 31) Diet/HBGM: 19% (<i>n</i> = 31)	OGTT: 55% (<i>n</i> = 55) RPG: 22% RPG: 22% (<i>n</i> = 55)	OGTT: 73% (<i>n</i> = 26) Diet/HBGM: 8% (<i>n</i> = 26) FPG: 8% (<i>n</i> = 26)	Diet/HBGM: 50.6% (<i>n</i> = 83)

HBGM, Home blood glucose monitoring.

**If a test was done on more than one occasion, e.g. at booking and 24 weeks, it was included twice (hence the total will exceed 169). ^aIf a test is done on more than one occasion, e.g. at booking and 24 weeks, it is included twice. Please note the variations in the denominator, as some responders did not fully complete the questionnaire.

Table 2 The 75 g OGTT timing and cut-off values in gestational diabetes

Timing of the OGTT (<i>n</i> =99) ^a		Cut-off fasting and 2 h values (<i>n</i> =82) ^b			
Timing (gestation week)	%	Fasting cut-off (mmol/l)	%	2 h cut-off (mmol/l)	%
24–28	65	5.5–5.9	15	7	2
<24	11	6	16	7.5	2
>28	10	7	10	7.8	10
If screen positive	14	7.8	1	8	6
On booking	1			8.5	2
				8.9	2
				9	15
				9.2	8
				10	1
				11.1	2
Others ^c		Others ^d			

^aNo regional variability trend could be detected ($P=0.27$).

^bDue to the wide variations, individual data groups were too small to calculate regional variability trends. ^c1st–2nd Trimester, Following 50 g OGTT, Big baby (1% each).

^dUnspecified timing (26%), according to WHO criteria, fasting 5.5 and random 9, random >5.5, 120 min to increase by 4 mmol/l (1% each).

Postpartum management

Most 90% (153/169) centres screen for diabetes postpartum and inform their patients of their high risk for future development of gestational diabetes and/or type 2 diabetes. The 75 g OGTT is the most commonly used test 93% (126/135). Again, no significant regional variability was observed.

Discussion

In the UK, there is lack of consensus on screening for GDM, with some centres adopting the ADA guidelines, others implementing the WHO criteria with or without the EASD modification, whilst others not screening at all. In 1999, a National survey of UK obstetric units was reported, with 81% of units screening according to maternal risk, 79% utilizing the 75 g OGTT (although cut-off values not specified).¹² In that study, it was suggested that 66% of participants 'would welcome' National guidelines.¹²

The reported variation in the incidence of GDM (0.1–10%) is based on local estimates, and may reflect the variation in screening policy and therefore possibly detection rates.

Whilst most (82%) centres screened routinely, there was a divide between universal (52%) vs.

selective (48%) screening. Wherever routine screening was not in place, lack of consensus was the main reason followed by operational obstacles. Approximately 50% timed their screening around 24–28 weeks, with reported alternative timings either before or after.

Unlike the ADA and WHO recommendations, which rely on maternal 'high-risk features',^{9,10} risk stratification was the first step in only 11% of UK centres. If adopted more widely, it is likely to enhance the screening efficacy and cost-effectiveness, avoiding unnecessary screening and confirmatory tests.

Glycosuria and RPG appeared the most frequently utilized screening tests in addition to being relied upon as the first screening test in the majority of centres.

Whilst the convenience and cost implications of glycosuria testing are understandable, its low specificity (in view of the gestation-related lowered renal threshold) could be responsible for unnecessary OGTTs, offsetting its initial cost advantages. Whilst 11% of an unselected obstetric population of ~1400 women had random glycosuria, only 1% had an abnormal OGTT.¹⁷ The popularity of the RPG, only second to glycosuria, is most likely a reflection of its convenience, despite its significant limitations. The original report on RPG²⁰ included no data on sensitivity and specificity. Subsequent work^{21–23} failed to identify satisfactory cut-off values, given the low correlation between RPG taken >120 min after a meal and the 2 h value of the OGTT ($r=0.22$).

The FPG started to gain popularity following the increased emphasis by the ADA and WHO guidelines for detecting DM outside pregnancy. Two studies—Reichelt *et al.*, 1998²⁴ and Peruchini *et al.*, 1999²⁵—evaluated the sensitivity and specificity of FPG against more standard methods for screening in GDM. Fasting venous glucose of 4.9 mmol/l in the first and 4.8 mmol/l in the second study yielded comparable sensitivity and specificity values (~80%) despite differences in the ethnic origin of their respective populations.

However, our survey confirmed that currently in the UK, FPG was the least likely to be used as a first screening test for GDM. Moreover, the timings and cut-off values varied widely, despite no significant regional variability, with cut-off values >5.5 in the majority of centres, significantly >4.8 suggested previously.

Once a screening test is positive, most centres proceed to the OGTT, with only few progressing directly to home glucose monitoring, diet and exercise. There was no regional variability for timing, cut-off values or subsequent action if screening is

positive, nor in the order of screening tests within the 10 regions of the UK.

Whilst most centres rely on OGTT for GDM confirmation, it was surprising to note the very wide variation in both the timing of the test and in the cut-off values adopted. To our knowledge, this is the first time that such significant variability in practice has been documented. This observation could have implications for clinical outcome where patients receive non-uniform care in different centres, e.g. they could be classified as having GDM by one set of cut-off values but not by another. Once again, there was no significant regional variability, i.e. the variation in practice was not simply related to different practices within different regions but to a more random and widespread lack of consensus.

Whilst no significant variability within different regions was observed, centres both initiated and monitored insulin therapy according to a wide variety of random, fasting and/or postprandial blood glucose values, and also in response to changes in foetal monitoring. This widespread variability may reflect the historical lack of objective evidence for successful intervention, in addition to local factors related to service organisation, patient convenience, etc.

Postpartum management appeared to be the most consistent aspect of the management of GDM, with the majority (91%) of centres screening with an OGTT postpartum and instructing their patients that they are at high risk for future development of GDM and/or type 2 diabetes.

Our report confirms in greater detail the continued wide variability in practice across the UK. This is contrast with the US where it was reported, >10 years ago, that despite the controversy surrounding the optimal management of GDM, programme directors of residency and maternal-foetal fellowship programmes were in agreement with many aspects of the diagnosis and management.²⁶

Our study has three potential limitations. Firstly, the average response rate was ~50% (range 35–67% by region), following the initial low response of 30%. Whilst a higher response rate would have been desirable, the following has to be considered. The non-responders included those centres that did not provide the service, referring their patients as well as centres not responding despite further contact and prompting, i.e. 'non-responders' are falsely over-represented. In addition, the data analysis confirmed the generalized lack of consensus, so it was felt that the available sample was successful in capturing the underlying problem and hence truly representatives of current practice. Furthermore, to ensure that the broad final range did not skew the findings, regional variability was

assessed by subdividing the UK into 10 regions. That did not reveal significant difference, confirming that variability in practice was not due to regional differences in managing GDM. Again, it should be emphasized that, whilst we relied on the ABCD as a vehicle to conduct the survey, most responders confirmed that they have joint clinics and therefore the response captured the joint practice rather than merely reflecting the individual clinicians filling in the questionnaire. Only a multidisciplinary approach can improve GDM management. That has also been emphasized in recent surveys.²⁷

Secondly, and similar to other surveys, the responses depend on individual interpretation and therefore, some discrepancy could be identified on detailed analysis, e.g. only 34% of responses confirmed that they assess the presence of 'High risk features', whilst almost half of those who screened for gestational diabetes, adopt a selective screening policy (39%). Whilst acknowledging that, we believe it does not undermine the main finding, i.e. lack of consensus. Again, whilst 98% of responses were from the diabetes team, the fact that 85% of units ran a 'joint' clinic provides reassurance that the views expressed in the survey reflected the multidisciplinary practice rather than the diabetes team only.

In addition, therapy section focused mainly on insulin therapy. Metformin was not specifically included in the questionnaire. Since the conclusion of the survey, various centres are increasingly using metformin, especially with the evolving data.²⁸

Most recently, the CEMACH report was presented, showing significant management problems with type 2 diabetes pregnancies, equivalent to those in type 1.¹⁸ The report emphasized the need for high risk group identification. Although GDM cases were specifically excluded from the survey, the enquiry and the recommendations, the observations in commentary¹⁹ that up to 20% of GDM could represent T2D first recognized in pregnancy, lends weight to the argument for consistency in diagnostic standards for GDM. An effective national screening strategy for GDM should form part of the broader initiative to help improve diabetes pregnancy outcomes. Regardless of the short-term complications of GDM, the long-term risk for future development of diabetes in both mothers and the offspring has significant public health implications, especially in the face of the diabetes pandemic. National (even international) consensus should be a priority for all stakeholders. A National Institute of Clinical Excellence Review is due to be released. That should establish a more 'unified' approach. However, that should encourage further research

and evidence gathering to further enhance GDM management.

In conclusion, we describe the results of a National survey of practice in the management of GDM, and conclude that, in the main, wide variation exists in the policy and practice of screening for the condition. The popularity of RPG is likely a reflection of its convenience given its significant limitations. Risk stratification is the first step in only 11% of UK centres, and if adopted more widely could have significant cost saving on subsequent screening tests. There is significant variability in the interpretation of OGTTs as well as the practice of insulin treatment. Whilst scientific evidence gathering (including for example the Hyperglycaemia and Pregnancy Outcomes 'HAPO' Study) and debate should continue to address areas of controversy in GDM, it should not preclude the urgent production of, and adherence to pragmatic 'National' guidelines.

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Appendix 1

Screening for gestational diabetes

About you: Hospital name and locality
 You are: Diabetologist Obstetrician/Gynaecologist
 Is there a **Joint Clinic** in your hospital Yes No
 Deliveries per annum in your unit
 Prevalence of Gestational DM %

Do you routinely screen for GDM? Yes No
 ■ If no, why? No need
 Lack of consensus in the U.K.
 Other, please specify

■ If yes; do you only screen **High risk** population: yes No
 (**High risk** parameters include: marked obesity, DM in first degree relative, history of glucose intolerance, previous infant with macrosomia or gestational DM)

Now, could you complete the information about the relevant test(s) that **you use**:

	gestational age on screening (weeks)	Cut-off values	Further action, if above cut-off value
1) Fasting glucose			
2) Random glucose			
3) 50 gram GTT			
4) HbA1c			
5) Glycosuria			
6) High risk features*		N/A	
7) 75 gram GTT			
8) 100 gram GTT			

■ **Sequence of tests** to screen then confirm the diagnosis:

■ **When do you initiate insulin therapy?**

Fasting glucose/BM mmol/l Random glucose/BM mmol/l
 one-hour glucose/BM mmol/l Two-hour glucose/BM mmol/l
 Other parameter, please specify

■ **Do you routinely arrange foetal growth scans?** yes No

■ **Do you screen for diabetes post-partum?** yes No
 If yes, which test do you use and when?

■ **Do you instruct your patients** that they are high risk for future development of Gestational DM Type II DM