**Current practice for diagnosing Gestational Diabetes Mellitus in women following bariatric surgery: a national survey of Lead Diabetes Midwives**

**Abstract**

Women of fertile age increasingly undergo bariatric surgery to manage their obesity. The numbers of conceptions and pregnancies following bariatric surgery are correspondingly likely to rise in the coming years. The standard oral glucose tolerance test can lead to dizziness, sweating and even collapse in people after some types of bariatric surgery. In view of this potential pitfall in the diagnosis of gestational diabetes (GDM) after bariatric surgery, we surveyed midwifery units to establish current practice for the screening and diagnosis of GDM in women who have had bariatric surgery. Out of 164 English obstetric units, 120 email surveys were sent to a network of Lead Diabetes Midwives in units across England; a reminder email was sent four weeks later.Twenty-seven (22.5%) responses were received. Five out of 27 respondants (26%) had specific policies in place to manage pregnancies after bariatric surgery. A wide variety of approaches to GDM screening and diagnosis were used in women with a history of bariatric surgery. The OGTT was the most widely used test after bariatric surgery. National clinical guidelines need to be developed for the diagnosis of GDM after bariatric surgery.

**Key phrases**

Numbers of women with pregnancies after bariatric surgery is set to rise in coming years.

A minority of centres have specific policies in place to manage pregnancies after bariatric surgery.

This study shows that the current practice to screen and diagnose gestational diabetes in this group of women is highly variable.

Work is needed to test the comparative performance of screening & diagnostic strategies for gestational diabetes in women after bariatric surgery, in order to develop clinical guidelines.

**Key words**: bariatric surgery, gestational diabetes

**Introduction**

In the UK, approximately one-fifth of women aged 16-40 years of age are obese (BMI >30kg/m2) and one-half of all women are either obese or overweight (Buchwald *et al*, 2009). Obesity is a substantial risk factor for type 2 diabetes (T2DM) and gestational diabetes. Women with pre-existing diabetes have a fivefold increased risk of stillbirth, threefold increased risk of perinatal mortality & threefold increased risk of fetal congenital anomaly (Macintosh *et al*, 2006;Bell *et al*, 2012; Tennant *et al*, 2014)).

Women are increasingly turning to bariatric surgery to manage their obesity; worldwide, 49% of patients undergoing bariatric surgery are women of childbearing age (18-45 years) (Roehrig *et al* 2007; Maggard *et al* 2008). Gastric banding, Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy are the most common procedures performed in the UK (UK National Bariatric Surgery Registry, 2014). Gastric banding may be considered a restrictive procedure as it limits the amount of food entering the stomach. Gastric bypass is sometimes considered to have a restrictive element (reduction in stomach size) as well as a malabsorptive component (due to a shortened length of intestine). Laparoscopic Sleeve Gastrectomy is performed in 16% of cases and involves the reduction of the size of the stomach to a quarter of its size. It is a more recent procedure and is capable of achieving significant weight loss, and T2DM remission (Kehagias *et al*, 2013).

The National Institute of Clinical and Health Excellence (NICE) recommends bariatric surgery as an option if BMI >35kg/m2 in the presence of one other risk factor (for example, type 2 diabetes) and if the patient has exhausted all other methods of weight loss and attended a specialist weight management clinic or its equivalent.

The prevalence of obesity is predicted to rise further and so will increasingly include women of child-bearing age. The numbers of conceptions and pregnancies following bariatric surgery are correspondingly likely to rise in the coming years. Furthermore, unplanned pregnancies may occur after surgery – obesity impairs female reproductive function and this may be improved by bariatric surgery (Legro *et al*, 2012)..

The risk of developing diabetes in pregnancies after bariatric surgery is contentious, in part because there are no guidelines for screening and diagnosis of gestational diabetes (GDM) or the re-emergence of Type 2 diabetes, following bariatric surgery.

. The usual test for GDM in pregnant women is the oral glucose tolerance test (OGTT). This test involves fasting the mother from 10 p.m. (water is permitted). The procedure ideally starts between 8.30 am and 10.00 am the following morning. A fasting venous sample is taken for glucose concentration and then 75g of anhydrous glucose (or its equivalent) is ingested in a volume of 300 mL over five minutes. Two hours later a further venous sample is taken for glucose concentration. However, ingesting a carbohydrate drink may cause ‘Late dumping’: this is a form of “reactive hypoglycemia,” and occurs 1–3 hours after meal ingestion following Roux-en-Y gastric bypass (RYGB), but rarely after sleeve gasrectomy and not after gastric band. After RYGB food exists the small stomach pouch quickly as the pylorus is now bypassed, and is rapidly absorbed from the proximal small intestine. There is a brisk rise in ‘incretin’ hormones (such as glucagon-like peptide-1) from the gut. Incretins cause a greaterinsulin response to hyperglycemia and can lead to hypoglycaemia. These patients present with dizziness, fatigue, sweating, weakness, nausea and vomiting and even collapse. Inducing these symptoms in a pregnant woman is clearly something to be avoided.

Aim

To survey lead diabetes midwifes to establish current practice for the screening and diagnosis of GDM in women who have had bariatric surgery. In particular, to determine whether the 75g OGTT was being used in women after bariatric surgery.

**Methods**

Of 164 obstetric units in England, a network exists of 120 Lead Diabetes Midwives. A cross-sectional e-mail survey of the members of the network was undertaken in August 2015, to assess current practice for the diagnosis of GDM in women with a history of bariatric surgery. The survey sought information on numbers of women with bariatric surgery ever encountered in their obstetric units, the GDM screening criteria employed and the gestational timing of screening, diagnostic criteria used and whether the criteria changed with type of bariatric surgical procedure. The questions were designed using statements with response categories, plus the option of open text boxes.

A second email was sent as a reminder four weeks after the initial email. The survey closed in October 2015. Responses were confidential and no data that might identify individuals or units were requested. Returned, completed questionnaires were considered indicative of consent to participate. The email text stated that the information may be used for publication. Ethical approval is not required for a survey of current practice. The project was deemed a service evaluation by the University of Surrey ethics committee and a local NHS Research & Development department. Descriptive statistics were performed using SPSS version 21 (IBM Corp., Armonk, NY, USA).

**Results**

One hundred and twenty emails were sent and twenty-seven responses were received (22.5%). The size of the maternity units ranged from 800 to 8000 births per annum (median 5000 births).

Twenty-six of the respondents (96%) had provided antenatal care to women after bariatric surgery.

Identification of women with previous bariatric surgery & pathways of care

The surgical history of the women was identified by patient self-report (n=25), referral or direct contact with surgical team (n=2), referral or direct contact with other health professional (n=8) or from review of medical records (n=9). Seven centres (26%) had specific policies in place for management of pregnancies after bariatric surgery. More units (n=10) had policies that made reference to bariatric surgery, 11 did not and five respondents were uncertain. There was a recognition that more intensive monitoring was indicated in these pregnancies: n=19 (73%) would refer to a specialist unit, n=24 (92%) would request involvement of more senior members of the team for input into the management, n=20 (77%) felt more frequent scheduling of appointments was indicated and n=17 (65%) would arrange for additional screening tests for pregnancy complications.

Screening criteria

A variety of approaches to GDM screening were used in women with a history of bariatric surgery (Figure 1). Screening predominantly occurred at booking or between 24 and 28 weeks (Figure 2). Four respondents provided an alternative response: one replied that screening would not be done, one at booking, one answered with random blood sugar at booking and OGTT at 24 weeks and one with a urine test at every appointment.

GDM diagnostic criteria

Following RYGB, GDM was diagnosed using a variety of methods (Figure 3; 18 respondents) but with the 75g OGTT being the most frequent method (n=12).

An OGTT criterion of 2-hour ≥7.8mmol/L was used in twelve centres: in which the fasting criteria was ≥5.3mmol/L in one centre, ≥5.6mmol/L in eight centres and ≥6.1mmol/L in three centres.

If the initial diagnostic test was negative, policy differed between centres as to follow-up assessment: eight would not retest, three did not know and seven would retest (two only if there was evidence of clinical features such as polyhydramnios or macrosomia; with the remaining five retesting between 24 and 28 weeks).

Five centres would use an alternative diagnostic test if surgery other than RYGB had occurred, eight would use the same test, and thirteen did not know. Of the five centres using an alternative test, two would use OGTT, two CGM and one HbA1c (threshold HbA1c >5.8%).

**Discussion**

In this study we identified considerable heterogeneity in the diagnostic pathways for GDM in pregnancies occurring after bariatric surgery. In particular, clinical practice differed as to whether to tailor a diagnostic test for GDM according to the type of bariatric surgery that had preceded the pregnancy.

In the last two decades, the proportion of patients with diabetes resolution after bariatric surgery varied widely depending upon both the type of surgery and the diagnostic criteria used [1]. In 2009 a consensus report from The American Diabetes Association defined remission of T2DM as a return to normal measures of glucose metabolism (HbA1c below 6%, fasting glucose less than 5·6 mmol/l) at least one year after bariatric surgery without hypoglycaemic medication (Buse *et al*, 2009). It may be the case that disparity in diagnostic criteria for GDM in this study relates to a wider difficulty of determining glycaemic status after bariatric surgery. The new, stringent criteria for diabetes remission led to a reduction in the reported frequency of diabetes resolution (Pournaras *et al*, 2012), although RYGB remains more efficacious at diabetes resolution than gastric band. Remission of T2DM, before any significant weight loss has taken place (after RYBG), has been partly attributed to a change in gut hormone (incretin) secretion (Knop & Taylor, 2013). Based upon data from clinical coding, the rate of GDM after bariatric surgery may be reduced by up to 75% – however, the criteria used to diagnose GDM were not reported (Burke *et al* 2010; Johansson *et al* 2015). Pregnancy itself has been reported to lead to a brisk incretin response but it is not known whether this is in addition to the response seen after bariatric surgery (Valsamakis *et al*, 2010).

Most midwives replied that their unit would refer a mother with a history of bariatric surgery for specialist review. This may reflect concern about the health outcomes to the mother or fetus in these pregnancies. A recent meta-analysis suggests that women becoming pregnant after metabolic surgery have increased risk for premature and small-for-gestational-age babies and so may be considered high-risk (Johansson *et al*, 2015). However, it has yet to be proven whether these risks are in addition to the known pregnancy risk factors of diabetes and obesity. Provision of preconception clinics for these women is often lacking and therefore a dieitican review ought to be considered at booking.

Despite most respondents having cared for pregnant women with a history of bariatric surgery, a much lower proportion worked in centres that had specific protocols in place for this group of women. Given the rise in prevalence of obesity and hence surgical procedures, this is area that needs addressing. Furthermore, the high percentage of respondents using an OGTT to diagnose GDM after RYGB is concerning as this test can induce significant adverse symptoms due to the associated ‘dumping’ syndrome. At the current time there is no evidence base for alternatives to the OGTT to diagnose diabetes in pregnancy. A pragmatic approach is for frequent self-monitoring of blood glucose with pre and post-meal testing. Continuous glucose monitoring systems may prove to be helpful to identify periods of hyper or hypoglycemia and glycemic variability (Bonis *et al*, 2016).

Limitations

Response representativeness is more important than response rate in survey research andin this survey all but one of the respindants had seen women with pregnancies following bariatric surgery and a clear majority of the lead diabetes midwives surveyed used OGTT in women after RYGB. However, the response rate of 22.5%in this survey increases the potential for non-reponse bias. Response rates to surveys are low and may be declining further (Cook *et al* 2009; Cho *et al* 2013). A meta-analysis found that online response rates of healthcare professional average at 38%, compared to 57% for postal surveys (Cho *et al* 2013). Factors that enhance response rates include monetary incentives, shorter questionnaires, relevance of the survey topic, use of reminders and prenotification contact (McColl *et al* 2001). Our questionnaire was limited to a maximum of 23 questions and we used one reminder. Feedback received was that the study was highly relevant.

Conclusion

This survey had highlighted divergent practice in the diagnosis of GDM after bariatric surgery in the UK. Clinical trials are needed to test the comparative performance of screening & diagnostic strategies for GDM in women after bariatric surgery, in order to develop clinical guidelines.

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**Conflict of interest statement**

The authors declare no conflict of interest.

**Figure Legends**

Figure 1*.* Screening tests for GDM used in women with a history of bariatric surgery.

Figure 2*.* Time point during pregnancy when GDM screening takes place in women with history of bariatric surgery.

Figure 3. Diagnostic test used for GDM in women with a history of Roux-en-Y gastric bypass surgery.

CGM: capillary glucose monitoring, CGMS: continuous glucose monitoring system; HbA1c: glycated haemoglobin; OGTT: oral glucose tolerance test

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Figure 1.



Figure 2.



Figure 3.

