Clinical Practices

Guidelines for the Management of Diabetes in Pregnancy

HRB Health Research Board

ATLANTIC D.I.P

OÉ Gaillimh NUI Galway

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Contents

Introduction

These guidelines are intended for use by Midwives, Registered Nurses, Obstetricians, Physicians and General Practitioners responsible for the care of women with diabetes who are pregnant or who are intending a pregnancy and for those with gestational diabetes.

Diabetes is the most common medical disorder of pregnancy and complicates 4 per 1000 pregnancies. The outcome of a diabetic pregnancy should approximate to that of a non-diabetic pregnancy (*St Vincent Declaration*, 1989). However, even with the recent improvements in diabetic and obstetric care, the perinatal mortality rate remains 3.5 time higher, the stillbirth rate remains 5 times higher and the incidence of congenital malformation remains twice the rate as for non-diabetic pregnancies. (Atlantic DIP: Diabetes Care 2009). The Atlantic DIP Report 2009 found that 12% of deliveries in women with diabetes were preterm and the Caesarean rate was 43%. Birthweight was above 4000g in 32% of pregnancies. In a recent *CEMACH* report 36% of deliveries were preterm and the Caesarian rate 67%. Birth weight was above 4000g in 21% and above 4,500g in 5.7%, 7.9% of births resulted in shoulder dystocia (*CEMACH* 2003/4 and *CMACE* 2006/8). The risks associated with pregnancy for women with type 2 diabetes are equal to those with type 1 diabetes. The incidence of pregnancy in patients with type 2 diabetes is increasing and in the Atlantic DIP is around 25% of all pregestational diabetic pregnancies. Many of these pregestational type 2 diabetic pregnancies are in non-Caucasian women from areas of high social deprivation (*CEMACH* 2003/4 and *CMACE* 2006/8).

Until recently it has been uncertain whether active management of glycaemia in women with gestational diabetes would have a positive effect on outcome. This has now been shown to be the case by the ACHOIS study (*Crowther et al* 2005) with significantly fewer serious perinatal complications with improved health status for the mothers.

Aims

These guidelines aim to promote a high quality service to women with diabetes in order to ensure that the outcome for mother and baby matches that of nondiabetic women. In this respect, it provides a common framework to all professionals involved in the care of pregnant women at risk of, or with, gestational diabetes and those with pre-existing diabetes.

Definitions

For the purpose of this document only, pregnancy refers to the period from conception to delivery OR from a first positive pregnancy test to delivery and the immediate post-partum period.

Diabetes Mellitus – describes a metabolic disorder of multiple etiologies characterised by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or both.

Type 1 Diabetes – encompasses the majority of cases that are primarily due to pancreatic islet beta-cell destruction and are prone to ketoacidosis. It is characterised by absolute insulin deficiency, abrupt onset of severe symptoms and dependence on exogenous insulin to sustain life.

Type 2 Diabetes – is the major form of diabetes, which results from defects in insulin secretion, almost always with a major contribution from insulin resistance. It was previously referred to as maturity onset diabetes and can often be asymptomatic and, therefore, can remain undiagnosed. Type 2 diabetes is increasing in prevalence in women of childbearing age and is seen more frequently in Asian and Afro Caribbean women.

Gestational Diabetes – Carbohydrate intolerance of variable severity with onset or first recognition during pregnancy. It includes women with impaired glucose tolerance (IGT) and impaired fasting glucose (IFG). In the HSE West the ATLANTIC DIP study shows that glucose intolerance affects at least 1:10 pregnancies.

Preconceptual Care

PATIENTS WITH ESTABLISHED TYPE 1 AND TYPE 2 DIABETES

Pregnancy in a woman with preexisting type 1 or type 2 diabetes is often referred to in the obstetric literature as 'pre-gestational diabetes'. It occurs in approximately 4 per 1000 pregnancies. These are a high-risk group of patients that continue to have poorer fetal outcome, principally due to congenital malformations and stillbirth.

Women of childbearing age with diabetes should receive preconceptual care to optimize glycaemic control and ensure all other issues are addressed. Pre-pregnancy care outlined below should be part of their routine diabetes care whatever the setting.

The role of pre-pregnancy care is to review medical and obstetric history; advise on glycaemic control to optimise Glycated Haemoglobin (HbA1c) and to screen for and manage complications. All women with established diabetes mellitus should be provided with easily accessible specialist preconception services. In addition women with previous gestational diabetes should also be encouraged to attend. The following issues need to be addressed in all women with diabetes planning a pregnancy.

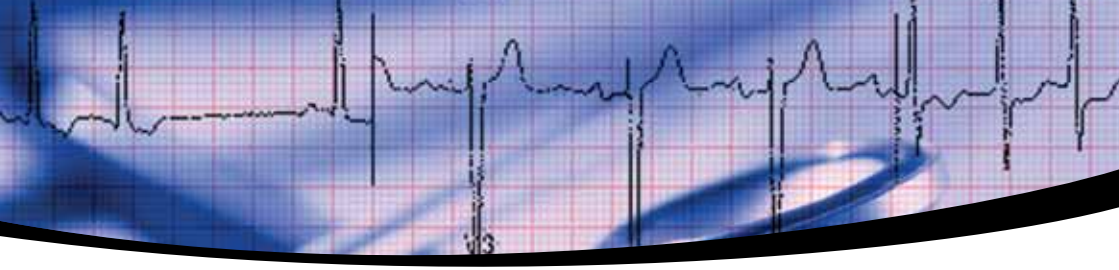
Risks of the Diabetic pregnancy

Risks to the mother

- Hypoglycaemia/Hyperglycaemia
- Ketoacidosis
- Caesarian section
- Retinopathy
- Hypertension/pre-eclampsia
- Nephropathy

Risks to fetus

- Miscarriage
- Still birth/neonatal death
- Congenital malformation
- Premature delivery (spontaneous or iatrogenic)
- Birth trauma secondary to macrosomia
- Neonatal hypoglycaemia
- Neonatal polycythaemia
- Neonatal hypocalcaemia
- Neonatal hyperbilirubinaemia
- Neonatal cardiomyopathy



Risk of Diabetes to Offspring

If the mother has type 1 diabetes the risk of the child getting it is 2-3%, while the father gives a risk of 5-6% to the child.

Counselling and Contraception advice

The need for preparation for pregnancy and preconceptual counselling should be emphasized during each and every diabetes annual review appointment in all women with diabetes and of child bearing potential, with further advice at interim visits as appropriate, whether hospital or community based. Every opportunity should be taken to promote the need for preconcep-tual counselling at community diabetes or other health care related events and contact details for the local diabetes preconceptual counselling clinics given. All women with dia-betes should have a planned pregnancy and intensive preparation should ideally begin 3 to 6 months before the desired time of con-ception. Contraceptives should be continued until HbA1c has been optimised. The choice of contraceptives is generally the same as in non diabetic women except if women have vascular complications or hypertension. In these women the combined oral contracep-tive pill should be avoided. The progesterone only pill or the Mirena coil are suitable alterna-tives. The woman should be able to meet the team who will be looking after her during a pregnancy and should be made aware of the risks and demands of pregnancy.

Glycaemic control

Women should be advised of the benefits of good diabetic control prior to trying for pregnancy (i.e. normal HbA1c - decreases risk of miscarriage, congenital anomalies, stillbirth and neonatal death.), (*Murphy, H.* Diabetes Care, Jan. 2011). Insulin should be adjusted to obtain an HbA1c as near to the normal range as possible (< 6%). For those already on insulin the regime should be changed if necessary, usually to a basal bolus regime. Women with type 2 diabetes should be managed with diet alone or diet plus insulin as oral hypoglycaemic agents are not approved for use in pregnancy although use of metformin is being considered and used more commonly prior to, and in early pregnancy, in those with type 2 diabetes (*Hawthorne*, 2006, MiG Trial 2008). In terms of insulin analogues, a RCT on the use of Novorapid in pregnancy has shown comparable outcomes to human insulin but with less hypoglycaemia (*Mathiesen, 2011*). Long-acting insulin analogues also appear safe for use in pregnancy and have begun to replace the traditionally used isophane insulin in clinical practice *(Mathiesen, 2012)*. Detemir in particular, is approved for use in pregnancy and a recent study indicates that it does not cross the human placenta *(Suffecool, 2015).*

Continuous subcutaneous infusion of insulin may be considered for those otherwise unable to meet glycaemic targets.

Glucose monitoring

Glucose monitoring technique and frequency should be reviewed and an up to date meter provided. For women with Type 1 diabetes, blood or urinary ketone testing should be taught. Women are encouraged to record blood glucose measurements 7 times/day; fasting, pre meals, 1hr post meals and before bed. If there is a suspicion of nocturnal hypoglycaemia, measurements during the night should occur. Blood glucose targets are fasting and pre meal values of 3.5-5.5 mmol/l, and 1 hour post meals of <7mmol/l. Hypoglycaemia should be discussed and education on using dextrose tablets, Hypostop and Glucagon documented.

Review of medications

Medications should be reviewed and discontinued where indicated. Patients on Angiotensin Converting Enzyme (ACE) inhibitors and Angiotensin Receptor blockers (ARBs) should have these medications stopped and alternative anti hypertensive medications commenced as necessary. Labetolol, nifedipine and methyldopa are safe in pregnancy.

Nutritional Management

It is good clinical practice to provide dietary advice before, during and after pregnancy. The advice should be for a diet in which carbohydrate is well distributed, based on low glycaemic index foods and not excessive in fat. Women should be encouraged to achieve a normal body mass index (BMI) prior to pregnancy as the ATLANTIC DIP programme has shown that obesity is an independent risk factor for increased maternal and neonatal morbidities (*Dennedy, MC,* 2010).

Gestational Weight Gain

Excessive weight gain during pregnancy is a risk factor for adverse pregnancy outcomes. Women should be advised preconceptually on expected weight gain during pregnancy according to BMI as outlined in the table below (*IOM* , 2009)

Folic Acid Supplementation

All women with diabetes who are planning a pregnancy should be prescribed 5mg folic acid daily, continuing up to 12 weeks gestation(*NICE*, 2015).

BMI (Kg/m^2)	Recommended Total Weight Gain	Recommended weight gain (kg/week): Trimesters 2 & 3
<18.5	12.5 - 18.0	0.51 (0.44 - 0.58)
18.5 - 24.9	11.5 - 16.0	0.42 (0.35 - 0.50)
25.0 - 29.9	7.0 - 11.5	0.28 (0.23 - 0.33)
>/= 30.0	5.0 - 9.0	0.22 (0.17 - 0.27)

Screening for complications:

Nephropathy and Hypertension

There is an association between pre-existing nephropathy and a poorer pregnancy outcome. (*Dunne et al* QJM 2000. *Mullers et al*. 2007). Worsening nephropathy and superimposed pre-eclampsia are the most common causes of pre-term delivery in women with diabetes. Thus urine for Albumin Creatinine Ratio (ACR) or Protein Creatinine Ratio (PCR) must be measured in all women to identify their renal status prior to pregnancy. A base line serum creatinine and estimated Glomerular Filtration Rate (eGFR) are also required. If the eGFR is < 40 at the beginning of pregnancy, the woman may experience irreversible further decline in renal function as a consequence of the pregnancy. Women need to be counselled about this fact.

Retinopathy

Retinopathy can deteriorate significantly during pregnancy (*Vestgaard, M et al*, 2010). Fundal examination by retinal photography is advised prior to conception and once in each trimester for those without retinopathy prior to pregnancy. For those with established retinopathy at the start of pregnancy, retinal examination every six weeks is advised. Rapid tightening of blood glucose control can also cause retinopaty to deteriorate, so vigilance is necessary. Women with active retinopathy should be under the care of an ophthalmologist and their opthalmologist advised if they are planning a pregnancy.

Additional Blood Tests

- Thyroid function plus thyroid antibodies if abnormal.
- Rubella antibodies should be measured where rubella status is unknown

Smoking cessation

All women planning pregnancy who smoke should be advised with respect to smoking cessation. Occasionally, women may also need referral for alcohol or drugs counselling.

Gestational Diabetes Mellitus

GDM

Gestational Diabetes Mellitus (GDM) is a disorder of glucose intolerance occurring for the first time in pregnancy. Increasing numbers of women in this group represent those with previously undiagnosed type 2 diabetes. This proportion will continue to increase with increasing maternal age and prevalence of type 2 diabetes in the general population.

GDM is associated with increased fetal and maternal morbidity and fetal mortality, particularly from macrosomia and occasionally from fetal hypoglycaemia. (*Crowther et al* 2005, *ATLANTIC DIP: O'Sullivan et al,* 2011). Targets for glycaemic control in these women should be as aggressive as for those with established pregestational diabetes. They are usually treated by diet alone or diet with insulin. Metformin is currently being studied for use in pregnancy. *(Hawthorne 2006, Rowan et al 2005).*

A diagnosis of GDM also identifies women at increasing risk of developing type 2 diabetes in the future. (*ATLANTIC DIP: O'Sullivan E. P. et al* Diabetologia 2011, *O'Reilly M.,* pending publication 2011)

Diagnosis of gestational diabetes:

As recommended by the International Association of Diabetes in Pregnancy Study Groups (IADPSG), a diagnosis of gestational diabetes is made when one or more values are met or exceeded (*IADPSG recommendations,* Diabetes Care, 2010) See Table below:

Diagnosis of GDM with 75g OGTT

Fasting	5.1 mmol/litre
1 hour	10.0 mmol/litre
2 hour	8.5 mmol/litre

Diagnosis of Diabetes Mellitus (laboratory glucose samples) during pregnancy the categories of Diabetes, Impaired Fasting Glucose and Impaired Glucose Tolerance are all classified as 'Gestational Diabetes'.

Screening for gestational diabetes

All patients with pre-existing diabetes or previous gestational diabetes should be referred directly to the diabetes antenatal clinic.

Current practice for screening for gestational diabetes varies. Many European countries offer universal screening. In view of the rising prevalence of glucose intolerance in pregnancy (circa 12% *Atlantic DIP: O'Sullivan, E.P. et al*, Diabetologia 2011) and rising overweight and obesity levels (circa 60% (*Dennedy, M.C. et al,* 2010) as identified by ATLANTIC DIP, **best practice is to recommend universal screening using a 75g oral glucose tolerance test (OGTT) at 24-28 weeks.**

If universal screening is not possible, then selective screening on the basis of high, medium and low risk (as in panels) should occur.

High Risk

Women with any one of the following risk factors should undergo a glucose tolerance test as soon as is feasible. If a woman is found not to have GDM at this initial screening, she should be re-tested between 24-28 weeks gestation.

- Severe obesity (BMI >30)
- Prior history of GDM or delivery of large-for-gestational-age infant
- Presence of glycosuria
- Diagnosis of polycystic ovarian syndrome (PCOS)
- Strong family history of Type 2 diabetes.
- Ethnicity (all ethnic sub groups)

Medium Risk

A woman with any one of the following risk factors should be screened at 24 to 28 weeks gestation.

- Body mass index 25-30
- Maternal age >30 years
- Long term steroids
- Previous unexplained perinatal death
- Polyhydramnios and/or macrosomia in existing pregnancy

Low Risk

Low risk status, which does not require GDM screening, is defined as women with ALL of the following characteristics:

- Age <25 years
- Weight normal before pregnancy (BMI </= 25)
- Caucasian
- No known diabetes in first-degree relatives
- No history of abnormal glucose tolerance
- No history of poor obstetrical outcome.

Gestational Diabetes Mellitus

GDM

NB

- Any blood glucose level (fasting or random) above 11.1 mmol/l is diagnostic of diabetes. The woman does not require an OGTT but should be referred to the Combined Diabetes Antenatal Clinic straight away.

- Any woman with glucose >11.1 mmol/l and ketones > ++ (or blood ketones >0.6 mmol/l) should be seen by the Diabetes Team on the same day.

Women must be booked for antenatal care as soon as they know that they are pregnant. All women with pregestational diabetes of any type (Type 1, Type 2 or secondary diabetes) or with gestational diabetes should be managed in a combined multidisciplinary antenatal clinic involving both diabetic and obstetric teams working together.

Diabetes Management

Glycaemic Control

Women are asked to keep a 7-point profile (pre- and post-prandial and at bedtime) and if there is concern about nocturnal hypoglycaemia or variable fasting glucose, they may also be asked to check occasional 3am glucose levels. The aim is to keep preprandial glucose in the range of <5.0 mmol/l fasting, postprandially <7 mmol/l if measured 1 hour postprandially and < 6.7 if measured 2 hours postprandially. A multidose injection (MDI) regime is recommended for the majority of women. Women are taught to adjust their own insulin doses. Frequent telephone contact is encouraged for those who need support with dose adjustment. HbA1c is checked at booking visit and repeated every 2-4 weeks. Target HbA1c is preferably < 6%.

Continuous subcutaneous glucose monitoring may be considered where additional information of glucose profiles could be helpful. Continuous subcutaneous infusion of insulin can be considered for those women unable to meet glycaemic targets during pregnancy. Guidelines for patients on CSII are given in appendices 11 and 12. **Women whose insulin requirements start to fall in pregnancy should be treated with concern and close monitoring of mother and baby is recommended as this may indicate declining placental function.** Pre-pregnancy insulin regime and insulin regime for after delivery must be clearly recorded in the medical notes, along with the need for sliding scale during delivery. If insulin is started in the first trimester the dose is 0.7 units/kg body weight per day, increasing to 0.8 units in the second trimester and 0.9 units in the third trimester. Between 36-40 weeks gestation the dose is 1 unit/kg body weight per day. While the standard sliding scale described in this document is appropriate for most women those with high insulin requirements, will need prescription of a sliding scale tailored to their individual requirements.

Diabetic Ketoacidosis in Pregnancy

Diabetic ketoacidosis (DKA) is a dangerous acute metabolic complication of diabetes associated with insulin deficiency, accelerated lipolysis, and hepatic glucose/ketone production with hyperglycemia and ketonemia, severe depletion of water and electrolytes from both the intracellular (ICF) and extracellular fluid (ECF) compartments, possible hyperosmolality in the extracellular space and mental obtundation, and increased anion gap metabolic acidosis. DKA may appear in diabetic women of any age.

Prevention of DKA is paramount in pregnancy due to the possibility of fetal mortality. Patient education about sick day management, frequent blood glucose testing, increased insulin doses, and the significance of vomiting and dehydration is of the utmost importance. All staff should maintain a high index of suspicion for DKA in diabetic pregnant women with nausea, vomiting, abdominal pain, fever and poor oral intake. All pregnant women are instructed to test for urinary or plasma ketones if they are unwell, particularly if vomiting, and to contact the Diabetes Specialist Nurse or maternity department immediately for advice if ketones are found. There should be a low threshold for admission to hospital in women who may be developing DKA. Initial DKA care is best given in intensive or special care units with experience in the monitoring of high-risk pregnancies.

If ketoacidosis is confirmed then intensive management is indicated and will involve much more than just the prescription of a sliding scale. The Consultant Obstetrician and the Diabetes Team should be informed immediately. The opportunity for round the clock communication with clinical staff is vital.

See appendices for summaries for use in clinic setting and for inclusion in the woman's notes:

Table 1, Appendix 5: Diagnostic Criteria for DKA.
Table 2, Appendix 5: Evaluation of patients with suspected DKA.
Table 3, Appendix 5: Management of patients with DKA during pregnancy.

Source: Herman, W.H., MD, MPH and J. L. Kitzmiller, MD, 2008, "Management of Diabetic/Medical Complications in pregnancy", Kitzmiller, J.L, Jovanovic, L, Brown, F, Coustan,D, Reader, D.M., Editors. ***Managing Preexisting Diabetes and Pregnancy, Technical Reviews and Consensus Recommendations for Care****, p. 270-275, American Diabetes Association, Virginia 22311, USA.*

Nutrition

All women should see a dietician early in the pregnancy. Daily nutritional requirements are given as 40% carbohydrate, 30% fat and 30% protein approximately. For overweight women with type 2 diabetes, special attention needs to be given to portion size. Women should be advised on appropriate gestational weight gain according to the table on page 8. Vitamin D supplementation is recommended to women who are pregnant (or breast feeding) and of Asian origin (Calcium and Vitamin D or Vitamin D alone – ergocalciferol 10mcg).

Vomiting

All women are instructed in how to cope with vomiting. Women with severe nausea of pregnancy should be treated with an-tiemetics and those with severe vomiting hospitalised promptly. Thyroid function tests should be checked in cases of hyperemesis gravidarum.

Hypoglycaemia

All women are taught how to avoid and manage hypoglycaemia. It is recommended that partners of all women with pregestational diabetes should be given a glucagon kit and taught how to use it. This is of particular importance in those with type 1 diabetes and for those with frequent hypoglycaemia.

Complications, screening and monitoring

Nephropathy and Hypertension

There is an association between preex-isting nephropathy (microalbuminuria or proteinuria) and a poor pregnancy outcome. Proteinuria increases transiently during pregnancy, returning to pre-pregnancy level within three months of delivery. The incidence of worsening chronic hypertension or pregnancy– induced hypertension/pre-eclampsia is high (varying from 40% to 73% across series) in women with both incipient and overt nephropathy.

Women should be screened for albumin excretion at booking and/or in the first or second trimester. Microalbuminuria is defined as an albumin to creatinine ratio (ACR) of 3.5mg/mmol, proteinuria >35mg/mmol if confirmed on a second sample. The normal reference range in a non-pregnant woman for a protein to creatinine ratio (PCR) is <30 mg protein/mmol creatinine. Trace proteinuria: 30 - 44 mg/mmol. A PCR of 45 or greater indicates overt proteinuria.

All women with nephropathy will need close monitoring prior to and during pregnancy. Monitoring may be by morning sample for albumin creatinine ratio (ACR) or protein creatinine ratio (PCR). For those with high-grade proteinuria a 24-hour urine collection for proteinuria may be requested particularly if the patient is suspected of having nephrotic syndrome.

Threshold for initiation of treatment and target blood pressure will be an individual decision. For those with microalbuminuria a target of below 140/90 is suggested with lower targets for those with nephrotic range proteinuria and oedema. 24 hour blood pressure monitoring should be considered where there is uncertainty as to whether targets are being met. Methyldopa is an appropriate first line agent. Second line agents are labetalol and nifedipine according to the worman's preference, stage of pregnancy and local pregnancy guidelines on hypertensive disorders of pregnancy.

Retinopathy

Retinopathy may progress during pregnancy (*Vestgaard M, et al* 2010). Fundal examination should be carried out in each trimester. More frequent assessment may be required in those with poor glycaemic control or hypertension as these factors are independently associated with progression of retinopathy (*Vestgaard M,* 2010). Early referral of women with moderate retinopathy to an ophthalmologist is recommended due to the potential for rapid development of neovascularisation.

Asprin

There is insufficient evidence to currently recommend the routine use of asprin in pregnancy. It may be considered in women at high risk of preeclampsia, nephropathy and retinopathy.

Low molecular weight heparin (LMWH)

The use of LMWHs for the prophylaxis of venous thromboembolism and other complications in pregnancy is becoming more common. This should also be considered in women with an inherited or acquired thrombophilia or women with proteinuria in the nephrotic range.

Obstetric Management

- A dating ultrasound scan is performed at 11-14 weeks to accurately date the pregnancy.

- Routine review at the diabetes antenatal diabetes clinic every 2-4 weeks up to 34 weeks and weekly thereafter.
- Detailed fetal anomaly scan, including a detailed cardiac scan is performed at 20 weeks. This should be performed by an RCOG/RCR accredited practitioner (or with equivalent qualification).
- Growth scans should be performed at 28 and 34 weeks with more frequent scans where clinically indicated.
- Different methods of fetal monitoring from 34 weeks gestation can be employed including the use of CTGs, ultrasonic evaluation of fetal liquor volume and umbilical artery dopplers. There is no clear evidence that any method of fetal monitoring is predictive of poor perinatal outcome in diabetic pregnancies.
- During labour and delivery continuous electronic fetal heart rate monitoring is recommended and fetal blood sampling should be available when requested (*Diabetes NSF*).
- Women should be instructed on the importance of monitoring fetal movements and told to contact the obstetric unit if there is any suspicion of and reduction of fetal movements. At least 10 kicks/day should be recorded.

Timing and mode of delivery

The timing and mode of delivery needs detailed discussion with the woman and MUST involve Senior Obstetric input. The risk of stillbirth needs to be balanced against the risks of induction of labour (IOL) at 38-39 weeks and the success rate of vaginal delivery following IOL (38% in those with Type 1 and 64% in those with Type 2 diabetes).

The practice of 'routine induction of labour at 38 weeks' for all women with pregestational or gestational diabetes is outmoded and should be abandoned, the decision should be made on an individual woman basis.

The increased risks of stillbirth, although difficult to accurately quantify, need to be considered along with risk factors such as prepregnancy and within pregnancy glycaemic control, evidence of fetal macrosomia, compliance with glucose and fetal monitoring and where relevant previous pregnancy outcomes.

Patients with Gestational Diabetes

The individual birth plan wishes of the woman should be taken into account and a plan of delivery, agreed between the woman and the obstetric team, should be clearly documented in the notes.

Antenatal Care

Women with gestational diabetes should aim for the same target glucose levels as in type 1 and type 2 diabetes. HbA1c targets should be a value of <6.0%. If, after a trial of dietary intervention, fasting glucose levels exceed 5 mmol/l and 1 hour post-prandial levels exceed 7 mmol/l on three or more occasions, intensive management with insulin is appropriate.

Obstetric Management

For women with gestational diabetes on insulin, management is the same as for Type 1 or Type 2 diabetes. For women with gestational diabetes on diet control only, obstetric management should be as for any routine pregnancy with consideration of induction of labour at term on an individual case basis.

Management During Labour

Type 1 and type 2 Diabetes

Spontaneous Labour

Once labour is established an insulin sliding scale should be commenced. Women should be allowed light diet if desired during labour.

Chart hourly blood glucose. Aim to maintain glucose concentrations of between 4.0 and 7.0 mmol/litre. This will help prevent neonatal hypoglycaemia.

BLOOD GLUCOSE (BG)	INSULIN RATE/HR (mls/h)
0 - 4	0.5* **
4.1 - 6	1
6.1- 8	2
8.1 - 10	3
10.1 - 12	4
12.1+	6

* Infusion rate of 0 mls/hr for glucose 0-4 mmol/l may be used in Type 2 or gestational diabetes, but for Type 1, start insulin infusion at 0.5mls/hr.

** For glucoses < 4.0 mmol/l stop infusion for 15 minutes and treat hypoglycamia, preferably orally, but otherwise with 50mls of Glucose 20%, or by temporarily increasing the Glucose 5% infusion rate by 50mls/hr. i.e. to 150mls/hr. Re-check blood glucose in 30 minutes.

Insulin sliding scale

Glucose Infusion

- 5% Glucose
- Run at 100 ml/hr using IVAC/ IMED pump.

Insulin Infusion

- Make up 50 units of soluble insulin (Actrapid), or rapid acting analogue insulin (Novorapid) in 50 ml of 0.9% Sodium Chloride. Start the infusion as directed by the blood glucose estimation (see sliding scale opposite).
- The rate of the glucose infusion is maintained at 100ml/hr throughout. The rate of the insulin is adjusted according to the blood glucose level, but it should not be necessary to discontinue the insulin infusion. If additional fluids are needed saline can be given alongside the glucose infusion.

Women on CSII pump therapy should continue to use their pump throughout labour and delivery. In the event of fasting for caesarian section, the background basal rate of insulin should continue without the need for bolus doses.

Insulin sliding scale (continued)

If blood glucose is running > 11 mmol/l or if the patient is unwell, check for ketones (euglycaemic ketoacidosis is recognized to occur in pregnancy).

If blood glucose is running > 9 mmol/l for two successive hours, adjust rate of insulin infusion (insulin rate/hr) according to sliding scale and as prescribed.

Women on >72 units of insulin per day prior to initiation of sliding scale are likely to need higher infusion rates. This should be discussed with the diabetes team in advance of the delivery if possible.

If fluid overload is a major concern, 500ml 10% glucose may be substituted and given at a rate of 50-70mls/hour. There is an increased risk of local phlebitis with 10% glucose.

Blood Glucose Monitoring

Check capillary blood glucose at least hourly to start with and at any time the blood glucose is outside the desired range or if the patient is ill.

Gestational Diabetes

Those on diet alone can be managed as if they did not have diabetes but glucose levels must be monitored hourly.

If glucose levels are consistently elevated during labour (>7.0 mmmol/l on 2 consecutive readings), start insulin infusion according to the protocol as for patients with type 1 diabetes.

Those on insulin should be managed as for patients with type 1 diabetes.

Note: Occasional patients with gestational diabetes needing only small doses of insulin to cover a main, usually evening, meal and who are to be delivered by caesarian section or who go into labour early in the day, may be managed without sliding scale provided glucose levels are monitored hourly and remain below 7 mmol/l.

Management During Labour

Caesarian Section and Induction of Labour

Caesarean Section

Set up a glucose and insulin infusion at 08.00 hours (Caesarian) and on admission (spontaneous labour).

In cases of elective Caesarian Section, omit breakfast or subcutaneous insulin in the morning. In cases of spontaneous labour, the insulin and dextrose infusion should be started immediately irrespective of prior administration of subcutaneous insulin.

When possible, women on insulin should be prioritised early on the operative list. Intravenous antibiotics should be given prophylactically according to local practice.

Induction of Labour

Individual hospital guidelines may vary but generally all women on insulin being admitted for induction of labour will be admitted the evening prior to allow for timely commencement of the insulin infusion. All should be assessed vaginally on admission.

Using Oxytocin

When inducing or augmenting labour with oxytocin, this should be given in 0.9% Sodium Chloride. Under no circumstances should Hartmann's solution be used.

Unfavourable Cervix (Bishop's score < 5)

Prostaglandin pessary should be inserted at 07.00hrs (high risk women should not be induced overnight), accompanied by foetal monitoring for 20 to 60 minutes. They should have their normal insulin and carbohydrate intake. Vaginal examination should be repeated prior to taking the morning insulin. If further prostaglandin is required, then the normal morning insulin and breakfast should be given. In those instances where more than 2 doses of prostaglandin are required, then vaginal examination should be performed prior to meals and the guidelines above followed. If at any stage regular uterine activity estab-lishes, then the guidelines for labour should be followed.

Favourable Cervix

The normal evening insulin and carbohydrate should be given. In the morning, the woman should omit insulin and breakfast and be transferred to the delivery suite at 08.00 hours with insulin and dextrose infusions in place.

Delivery

The Consultant Obstetrician or Registrar must be present/easily accessible at the delivery should there be suspicion of foetal macrosomia. The Paediatrician must be present for delivery.

Post Delivery

Type 1 and Type 2 Diabetes

After the placenta has been delivered, immediately half the insulin infusion rate and continue to monitor the blood glucose levels every 2 hours. Continue to adjust the insulin infusion rate according to the blood glucose concentration, again keeping the glucose infusion constant.

- Continue the intravenous fluids and insulin infusion until ready to eat.
- Start subcutaneous insulin at the pre-pregnancy dose or planned regime with food, which will be documented in the notes.
- Discontinue the insulin infusion 30 – 60 minutes after the subcutaneous insulin injection to ensure overlap.
- Women who are breastfeeding may require additional carbohydrate or reduction in insulin doses by approximately 20%.
- Continue qds glucose monitoring (those breast feeding may also wish to check glucose during the night).
- Women who have received a recent dose of Lantus will have a greater tendency to hypoglycaemia after delivery and will require careful monitoring.

Gestational Diabetes

As soon as placenta is delivered, insulin infusion can be stopped in these women. Blood glucose monitoring should be continued prior to each meal and 1-2 hours postprandially for 24 hours post delivery. If all values are below 7 preprandially and below 11 postprandially the woman may discontinue testing. If above this level please request the advice of the diabetes team.

Special Circumstances

Hypertensive Disease

Where a woman with diabetes with significant hypertensive disease is in labour or being delivered, there should be discussion of the management at Consultant level between obstetricians, physicians and anaesthetists. The majority of patients will deliver by Caesarian Section.

Fluid regime for the pre-eclamptic woman is a total of 85ml/hour, which includes intake by oral and the IV routes. However, women with diabetes and significant hypertensive disease, who will have Glucose 5% at 100mls/hour in tandem with the sliding scale insulin, must have careful fluid management overseen by a senior obstetrician. If a reduction in infused volume is recommended 10% glucose can be run at 50 ml/hr.

Pre-term Labour

Tocolytics can be used in diabetic patients, but this must be discussed at Consultant level. An intensive care monitoring chart and strict fluid balance is mandatory.

Tocolytics produce hyperglycaemia and women started on these agents, should be started on an insulin sliding scale. Considerable care needs to be exercised with regard to fluid intake and glycaemic control. If the woman is nil by mouth, then she should also be commenced on 5% glucose infusion. However, if if she is eating and drinking, then she should be given the insulin on its own.

Special Circumstances

Steroids

Diabetes is not a contraindication for steroid use. Infants of diabetic mothers are, in fact, at increased risk of hyaline membrane disease and often are affected at more advanced gestations. Therefore, any woman in pre-term labour up to 36 weeks gestation should be given steroids, with consent, as long as no contraindications are found, (*Crowley et al*, 2001).

Woman with diabetes given steroids should be admitted to the antenatal unit. They need an intravenous infusion of insulin and if the patient is nil-by-mouth, then 5% Glucose infusion should be commenced at the same time. A sliding scale insulin regime will need to be continued for up to 12 hours after the last dose of steroids. Supplemental sliding scale, continuing the woman's basal insulin dose is an option for those on basal analogue insulins as part of a basal bolus regime.

Patients with gestational diabetes not on insulin should also be admitted for 2 hourly blood glucose monitoring, and sliding scale started if glucose levels rise above 7 mmol/l.

Postnatal Care

For women with Type 1 or Type 2 diabetes

Women with pre-existing diabetes should be seen for postnatal examination 6-12 weeks after birth. If a woman is planning a further pregnancy, she should be transferred to the Pre-Pregnancy Care Programme. If not, she should be referred back to the general diabetes service.

For women with gestational diabetes

A postnatal examination for women with gestational diabetes should be arranged for 6-12 weeks following the birth. A postnatal glucose tolerance test should be performed 6-12 weeks post partum.

Women with gestational diabetes should return to GP care after receiving appropriate dietary and lifestyle advice. The GP should be informed of the result of postnatal screening.

Annual screening with either OGTT or fasting and posprandial glucose measurement in the event of normalisation of the postnatal GTT is recommended.

Women planning another pregnancy within one year should be rebooked for the Pre-Pregnancy Clinic at an appropriate interval and a repeat pre-pregnancy OGTT rescheduled.

Neonatal Care[1]

- Neonates should be nursed at the mother's bedside unless admission to intensive care is necessary[2]
- Early breast feeding (within 1 hr) should be encouraged.
- Neonates of women with diabetes are at an increased risk of hypoglycaemia, macrosomia, respiratory distress and hypocalcaemia.[3]
- Following delivery, neonatal blood glucose concentration falls quickly then rises and stabilises by approximately 2-3 hours of birth.[4]
- Routine blood glucose measurement in the well baby at term during the first 2–3 hours after birth should be avoided; however where there is clinical concern blood sampling should be performed.[5]
- Screening for hypoglycaemia should generally be performed prior to the second feed (approximately 4-6 hrs) in the well baby at term.[6]
- The diagnosis of neonatal hypoglycaemia is controversial. No conclusive evidence exists that defines the optimum cut off point below which serious adverse short and long term neurodevelopmental outcomes occur. An operational threshold of a blood glucose level <2.6mmol/L has been proposed.[7]
- Blood glucose should be tested using a quality assured method which has been certified for neonatal use.[8]
- Hypoglycaemia should be confirmed by laboratory testing[9]
- Babies who display clinical signs of hypoglycaemia should be transferred to neonatal intensive care for intravenous dextrose bolus and intravenous fluids.[10]

Neonates should be nursed at the mother's bedside unless admission to intensive care is necessary

Early blood glucose testing in the well baby at term should be avoided

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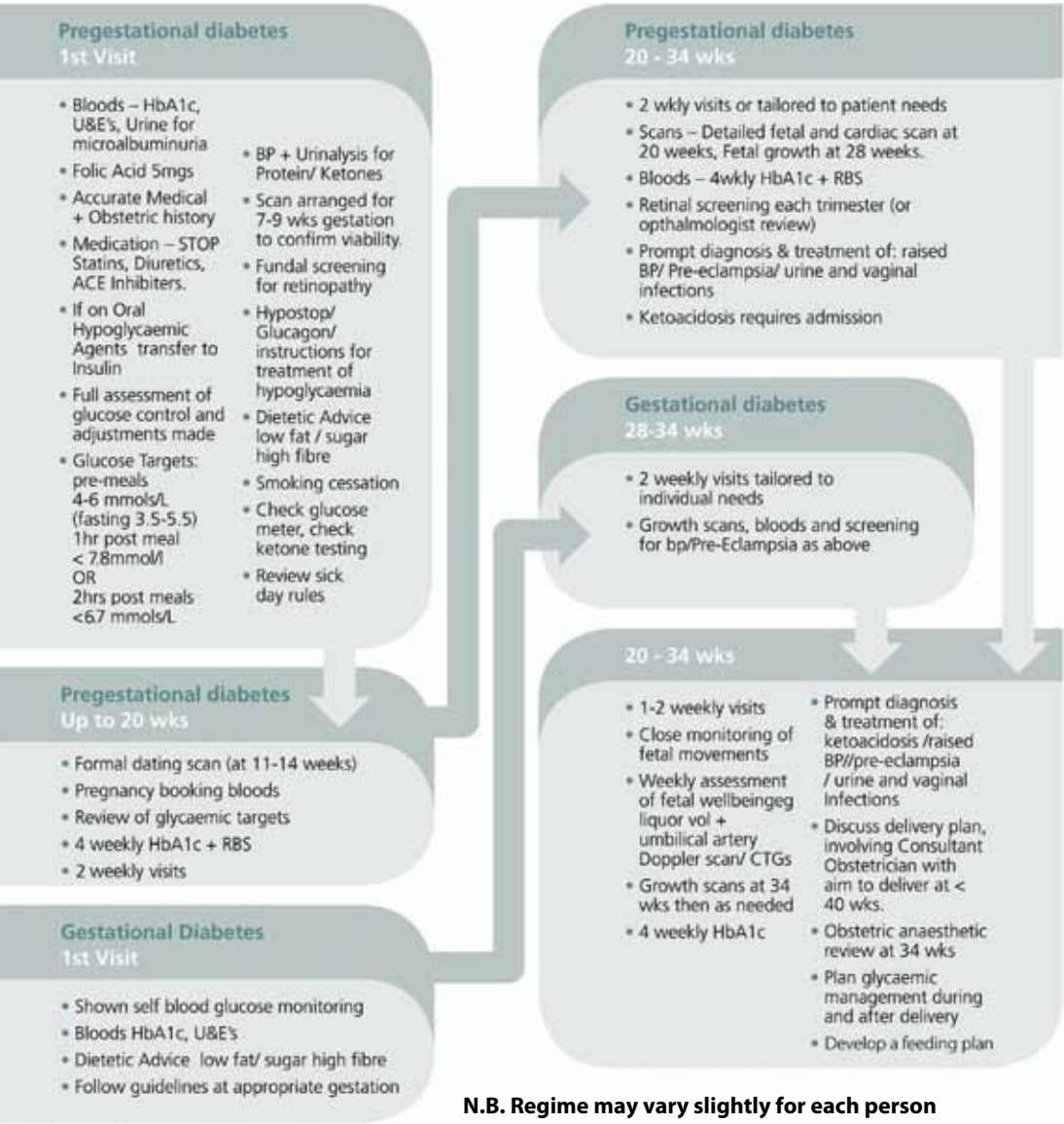
Appendix 1

Flow charts for use in clinic setting and for inclusion in patient's notes

Diabetic Antenatal Care



N.B. Regime may vary slightly for each person

Diabetic Intrapartum Care

Induction of Labour

- Aim to deliver at < 40 weeks gestation - decided on individual basis
- Inform Delivery suite of admission
- Routine admission and Induction procedure
- Continue present Insulin + diet regime until in labour
- Intermittent FH auscultation/ CTG
- Prescribe:
  - Sliding scale insulin + glucose regime
  - Glucagon (Type 1 diabetes)
  - Post delivery Insulin regime
- Aim to keep glucoses between 4 – 7mmols/L (Commence Sliding scale Insulin + glucose IV if not able to do so)
- Transfer to Delivery suite when in established labour or SROM

In established labour or for ARM

- Oral fluids for treatment of hypo's
- Commence IV sliding scale insulin + glucose as per protocol.
- Continuous CTG.
- 2 – 4 hourly cervical assessment for early diagnosis of obstructed labour

Syntocinon regime to be given via a separate venflon

- Low threshold for fetal blood sampling
- Be aware of shoulder dystocia and risk of fetal macrosomia
- Accurate documentation of partogram of maternal observations, fetal heart rate and progress of labour/ timing of interventions
- Senior obstetric involvement

For L.S.C.S.

- Admit day before
- Routine admission + C.T.G. monitoring
- Routine bloods. FBC. G&S. + pre – op procedure
- Inform Delivery suite of her admission.
- **DO NOT ALLOW TO GO HOME**
- Prescribe:
  - Sliding scale Insulin + glucose
  - Post delivery Insulin regime
  - Glucagon 1 mg (Type 1 diabetics)
- **N.B.M. from midnight.**
- Treat hypoglycaemia with glucose Tabs x 3 or Glucogel then transfer to Delivery suite for Sliding scale Insulin + glucose

Following morning

- Check vital signs
- Omit morning dose of insulin
- Listen to the fetal heart
- CTG monitoring
- Transfer to Delivery Suite/Theatre 07.00 - 08.00 hrs
- Commence IV Sliding scale Insulin + glucose as per protocol

When and how to stop a sliding scale insulin post delivery

Gestational Diabetes
- Stop Infusion once placenta delivered

Pre pregnancy Diabetes
- Ensure patient is eating and drinking normally
- Give Insulin when next due. (Regime in notes)
- Provide meal or snack.
- Stop Insulin + glucose after 30 mins

N.B. Regime may vary slightly for each person, please check notes

Appendix 3

Flow charts for use in clinic setting and for inclusion in patient's notes

Preterm Labour for women with diabetes

Betamethasone is a Steroid known to dramatically increase blood glucose levels in people who have Diabetes.

These women are already at a high risk of fetal distress so need close fetal monitoring.

- If delivery is indicated before 36 weeks gestation, im corticosteroids should be given for the prevention of neonatal respiratory distress syndrome
- **Commence sliding scale insulin within 2 hours of first injection**
- Commence IV sliding scale Insulin as per protocol at the first injection and continue for a minimum of 12 hours after the 2nd injection.
  IV glucose may be omitted if the woman is eating and drinking normally

- **Aim to keep glucose readings between 4 - 7 mmols/L**
  (If unable to do so, contact Diabetes Specialist Midwife/ Diabetes Medical Team for advice)
- Inform NICU (Neonatal Intensive Care Unit)

To stop sliding scale

- Give present regime of Insulin unless changed by Medical Team
- Give meal or snack
- Wait 30 minutes
- Stop IV Insulin

- Consider use of a tocolytic agent on an individual basis
- Senior obstetric involvement
- Continuous fetal CTG if in established preterm labour.

Appendix 4

Sliding scale insulin regime

Consider Sliding scale Insulin for:
Any pregnant woman with diabetes who needs Insulin injections who is-

- In established labour
- For ARM
- For a LSCS
- Nil by mouth (includes vomiting)
- For Betamethasone injections
- **Ketoacidosis needs accurate diagnosis and Consultant Obstetrician + Medical Team on call must be informed**

A combination of Insulin + glucose is given via the same venflon using a 'Y' connector

Insulin Regime

- 50 units Actrapid insulin added to 50 mls Normal saline in a 50 ml syringe(1ml = 1 units of Insulin) given via a syringe pump
- Adjust dose 1 hourly according to glucose levels

+/-

If NBM you must give

- 5% glucose 1000mls / 10 hourly (100 mls/hr via infusion pump)

Blood Glucose (mmols/L)	Insulin Infusion Rate mls/hr
0 - 4.0	0.5
Observe for hypoglycaemia	
4.1 - 6.0	1.0
6.1 - 8.0	2.0
8.1 - 10.0	3.0
If glucose > 9 for 2 hrs ask Dr to adjust sliding scale	
10.1 - 12.0	4.0
12.1 +	6.0
Check urine for: blood/ketones & inform medical team for advice	

When and how to stop a sliding scale insulin post delivery

Gestational Diabetes
- Stop Infusion once placenta delivered

Pre pregnancy Diabetes
- Ensure patient is eating and drinking normally
- Give Insulin when next due. (Regime in notes)
- Provide meal or snack.
- Stop Insulin + glucose infusion after 30 mins

Appendix 5

Flow charts for use in clinic setting and for inclusion in patient's notes

Diabetic Ketoacidosis in pregnancy

Initial DKA care is best given in intensive or special care units.

Table 1

Diagnostic Criteria for Diabetic Ketoacidosis (DKA) and Hyperosmolar Hyperglycemic State (HHS)

Parameter	DKA Mild	DKA Moderate	DKA Severe	HHS
Plasma glucose (mmol/l)	>11*	>13.9*	>13.9*	>33
Arterial pH	7.25-7.30	7.00-7.24	<7.00	>7.30
Serum bicarbonate (mEq/l.)	15-18	10-14.9	<10	>15
Urine ketones **	Positive	Positive	Positive	Small
Serum ketones**	Positive	Positive	Positive	Small
Effective serum osmolality (mOsm/kg)[a]	Variable	Variable	Variable	>320
Anion gap[b]	>10	>12	>12	Variable
Mental status	Alert	Alert/drowsy	Stupor/ coma	stupor/ coma

* *DKA can occur with a lower plasma glucose concentration in pregnancy.*

** *Nitroprusside reaction method.*

[a] *Calculation: 2 (measured Na(mEq/l.)+glucose (glucose/mmol)/18*

[b] *Calculation: (Na+)-(C1-+HCO3-)(mEq/l.).*

Appendix 5 (continued)

Flow charts for use in clinic setting and for inclusion in patient's notes

Table 2

Initial Clinical and Laboratory Evaluation of Patients with Suspected Diabetic Ketoacidosis

- Assess volume status by checking mentation, BP and HR, core temperature, skin turgor, and urine output by in-dwelling catheter.
- Monitor fetal HR and uterine contractions continuously.
- Immediate measurement of plasma glucose, urine ketones by dipstick, urinalysis, plasma beta-hydroxybutyrate, arterial blood gases, serum keatones, complete blood count (leukocytosis proportional to blood ketone concentration; if WBC >25,000 suspect infection), blood urea nitrogen, creatinine (can be elevated by acetoacetate in colorimetric assay), electrolytes (with calculated anion gap; (Na+ - (C1- + HCO3-)); normal 7-9mE/q/l with current ion-specific electrode methodology; check local laboratory normal ranges for electrolytes; correct serum sodium for hyperglycemia: for each 5.5 mmol/l glucose > 5.5 mmol/l, add 1.6 mEq to sodium value for corrected serum sodium value) calcium, magnesium, phosphate, and effective osmolality, ignoring permeable urea concentration (2(measured Na (mEq/l)+(glucose(mmol/l)/18).
- ECG, chest-Xray with abdomen shielded, urine, sputum, or blood cultures as indicated.
- HbA1c allows interpretation of previously undiagnosed or poorly controlled diabetes or truly acute episode in an otherwise well-controlled patient.
- Serum amylase and lipase may be elevated in DKA without pancreatitis.

BP, blood pressure, DKA, diabetic ketoacidosis, ECG, electrocardiogram, HR, heart rate, WBC, white blood count.

Appendix 5 (continued)

Flow charts for use in clinic setting and for inclusion in patient's notes

Table 3

Management of DKA During Pregnancy

IV Fluids: Isotonic sodium chloride; total replacement 4-6 L in first 12 h.

- Insert intravenous catheters. Maintain hourly flow sheet for fluids and electrolytes, potassium, insulin, laboratory results.
- Administer normal saline (0.9% NaCl) at 1.0-2.0 L/h for first hour.
- Infuse normal saline at 250-500 mL/h depending on hydration state x 8 hours. If serum sodium is elevated, use half-normal saline (0.45% NaCl).
- When plasma or serum glucose reaches 11 mmol/l, change to 5% dextrose with 0.45% NaCl at 150-250 mL/h.
- After 8 hours, use half-normal saline (0.45% NaCl) at 125 ml/h.

Potassium: Establish adequate renal function (urine output – 50mL/h).

- If serum potassium is <3.3 mEq/L, hold insulin and give 20-30mEqK+/h until K+ >3.3mEq/L or is being corrected.
- If serum K+ is >3.3 mEq/l but <5.3 mEq/L, give 20-30 mEq K+ in each litre of i.v. fluid to keep serum K+ between 4-5 mEq/L.
- If serum K+ is >5.3 mEq/L, do not give K+, but check serum K+ every 2 hours.

Insulin: Use regular insulin intravenously.

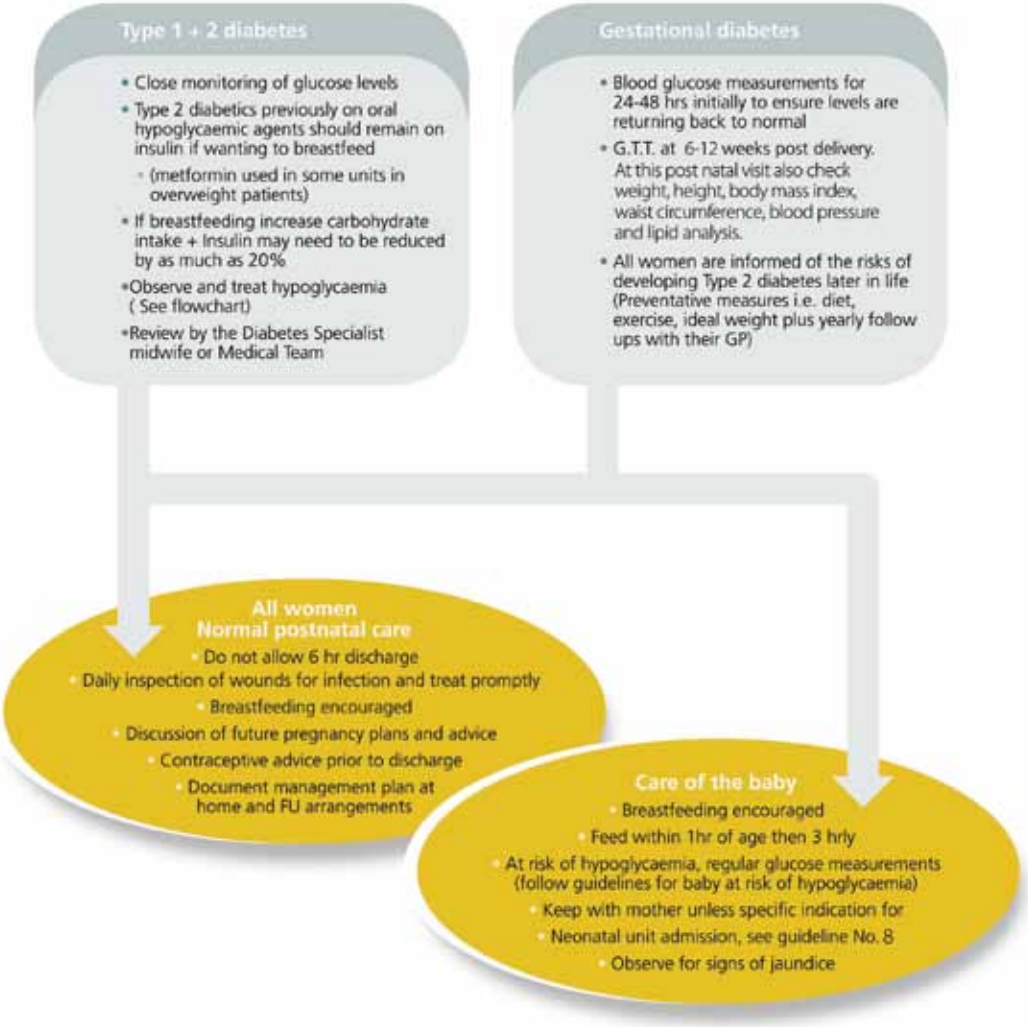
- Loading dose: 0.1 units/kg i.v. bolus if plasma glucose 8.3-16.5 mmol/l and 0.2 units/kg iv if plasma glucose >/=16.6.
- Begin continuous insulin infusion at 0.1 units/kg/h.
- If plasma or serum glucose does not fall by 2.8 – 3.8 mmol/l in first hour, double insulin infusion every hour until a steady glucose decline is achieved.
- When plasma or serum glucose reaches 11 mmol/l, reduce insulin infusion to 0.05 units/kg/h.
- Keep plasma or serum glucose between 5.5 and 8.3 mmol/l until resolution of DKA.

Assess need for bicarbonate:

- pH>7.0: No HCO 3
- pH 6.9-7.0: Dilute NaHCO3 (50 mmol) in 200 ml H20 with 10 mEq KCl and infuse over 1 h. Repeat NaHCO3 administration ever 2 h until pH>7.0. Monitor serum K+.
- pH<6.9: Dilute NaHCO3 (100 mmol) in 400 ml H20 with 20 mEq KCl and infuse for 2 h. Repeat NaHCO3 administration every 2 h until pH>7.0. Monitor serum K+.

Source: Herman, W.H., MD, MPH and J. L. Kitzmiller, MD, 2008, "Management of Diabetic/Medical Complications in pregnancy", Kitzmiller, J.L, Jovanovic, L, Brown, F, Coustan,D, Reader, D.M., Editors. ***Managing Preexisting Diabetes and Pregnancy, Technical Reviews and Consensus Recommendations for Care****, p. 270-275, American Diabetes Association, Virginia 22311, USA.*

Postnatal care for diabetes



Appendix 7

Prepregnancy advice for diabetes

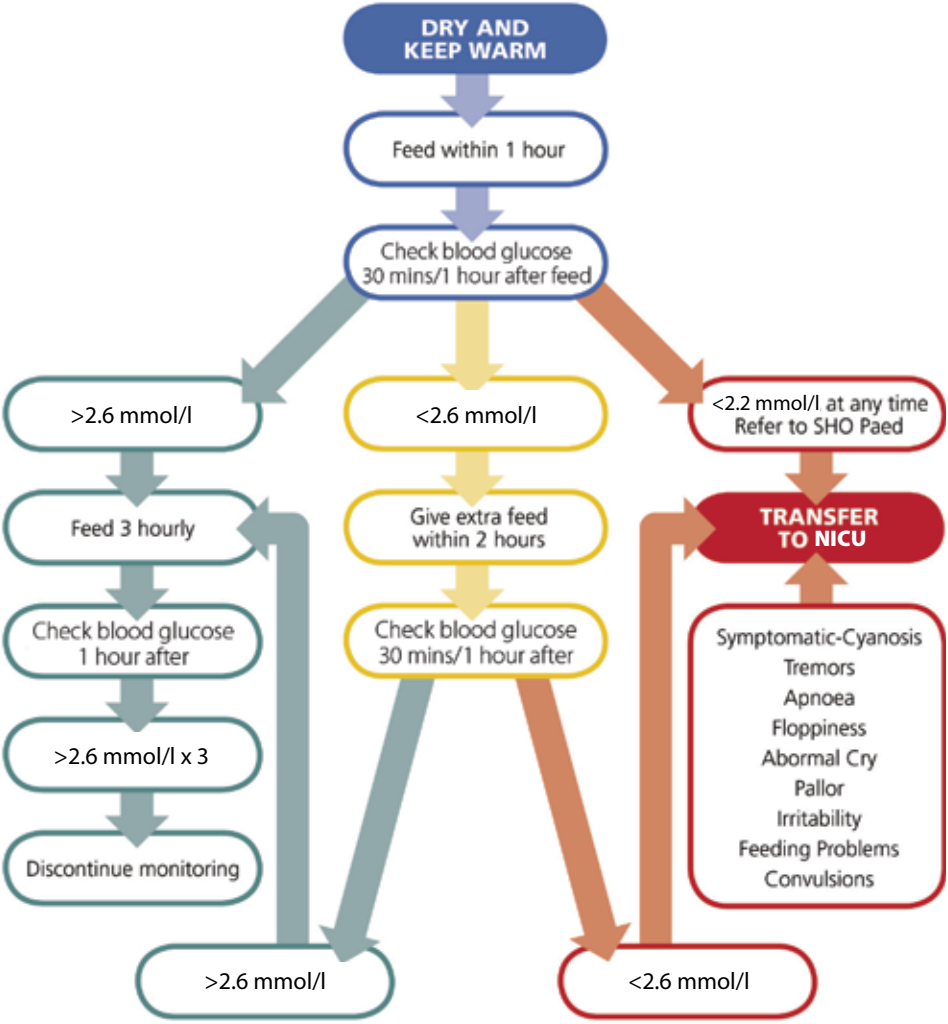
Clinics run on a regular basis at participating hospitals – enquire locally for timing

- Counselling regarding benefit of prepregnancy care and importance of good glycaemic control
- Assessment of glucose control over preceding 3 months (education on importance of good control)
- Capillary blood glucose testing qds – pre breakfast and either 1 or 2 hours post meals
- Glucose targets:
  - pre meals 4-6 mmols/L (fasting 3.5-5,5 mmol/l)
  - 1 hrs post meals 4-8 mmols/L or 2 hr post meals 4-7 mmol/l
- Bloods 3 monthly:
  - U&E's
  - HbA1c (aim for HbA1c <6%)
- Rubella status – ensure active immunity
- Urine for Microalbuminuria
- Folic Acid 5 mgs
- Micro and Macrovascular complications discussed with referral to appropriate medical team if needed
- Medication discussed: diuretics, statins and other contraindicated medication to be stopped/ changed
- Full retinal assessment with their optician and referred to ophthalmologist if needed
- Height, weight and BMI documented, dietary advice and support from Dietician
- Smoking cessation & referral if needed
- Contraception discussed and encouraged until good glucose control achieved
- Advice to contact Diabetes Specialist Nurse or Diabetes Midwife and GP after a +ve pregnancy test
- Relevant contact numbers documented for patient (eg written in glucose testing diary)

Appendix 8

Flow charts for use in clinic setting and for inclusion in patient's notes

Treatment of an infant at risk of hypoglycaemia



Appendix 9

Procedure for performing a glucose tolerance test

Preparation of Polycal for the Oral Glucose Tolerance

1. Measure 113ml Polycal into beaker.
2. Make up to a volume of 200mls by adding water.
3. Secure plastic cap firmly onto beaker and shake thoroughly.

Patient preparation

- Ensure patient is fit, well and free from infection
- Request that patient fast overnight for a minimum of 10 hours
- Inform the patient that smoking should not take place before
- Perform test in the morning or during procedure

Positive GTT

- Requires a follow up appointment
- Book appointment at earliest date with DSN or Diabetes Midwife and in next diabetic antenatal clinic

Fasting Glucose should be taken before 10 am

1. Prepare Polycal Drink – see preparation above
2. Obtain a venous glucose sample in the grey fluoride oxalate bottle
3. Gently invert the sample five times to mix the contents
4. Label the sample and laboratory form with patient's details
5. Label the bottle and laboratory form 'Time 0 hours'
6. Ensure that the sugar solution is fully dissolved and there is no sugar at the bottom of the glass after the patient has drank the solution.
7. Drink should be taken within 5 minutes of mixing.
8. Advise the patient to
   1) rest for the next hour until the next part of the test*
   2) remain fasting until test is complete(100mls water only)
   3) Abstain from smoking
9. On returning one hour later, check that the patient has been compliant with the above instructions (if not do not proceed with the test).
10. Check that it is 1 hour since the glucose drink was consumed.
11. Obtain a glucose sample in the grey fluoride oxalate bottle.
12. Invert gently five times to mix the contents.
13. Label the sample and laboratory form with patient's details.
14. Label the bottle and laboratory form "Time 1 hour"
15. Advise the patient to:
    1) rest for the next hour until the final part of the test*
    2) remain fasting until test is complete (water only)
    3) abstain from smoking.
16. On returning one hour later, check that the patient has been compliant with the above instructions (if not, do not proceed with the test)
17. Check that it is now two hours since the glucose drink was consumed.
18. Obtain a glucose sample in the grey fluoride oxalate bottle.
19. Invert gently five times to mix the contents
20. Label the sample and laboratory form with patient's details
21. Label the bottle and laboratory form "Time 2 hours".

* Instruct the patient to rest for the next two hours if possible, and to avoid any exercise, even walking. This is to avoid burning calories resulting in a lower glucose level at 1 and 2 hours. Smoking can affect glucose levels and must be avoided until the test is complete.

Appendix 10

Flow charts for use in clinic setting and for inclusion in patient's notes

Screening for gestational diabetes

All patients with pre-existing diabetes or previous GDM should be referred directly to the Diabetes Antenatal Clinic. Best practice is to recommend universal screening using a 75g oral glucose tolerance test(OGTT) at 24-28 weeks. If universal screening is not possible, then selective screening on the basis of high, medium and low risk (as in panels below) should occur:

High Risk

Women with any one of the following risk factors should undergo a glucose tolerance test as soon as is feasible. If a woman is found not to have GDM at this initial screening, she should be re-tested between 24-28 weeks gestation.

- Severe obesity (BMI >30)
- Prior history of GDM or delivery of large-for-gestational-age infant
- Presence of glycosuria
- Diagnosis of polycystic ovarian syndrome (PCOS)
- Strong family history of Type 2 diabetes.
- Ethnicity (all ethnic sub groups)

Medium Risk

A woman with any one of the following risk factors should be screened at 24 to 28 weeks gestation.

- Body mass index 25-30
- Maternal age >30 years
- Long term steroids
- Previous unexplained perinatal death
- Polyhydramnios and/or macrosomia in existing pregnancy

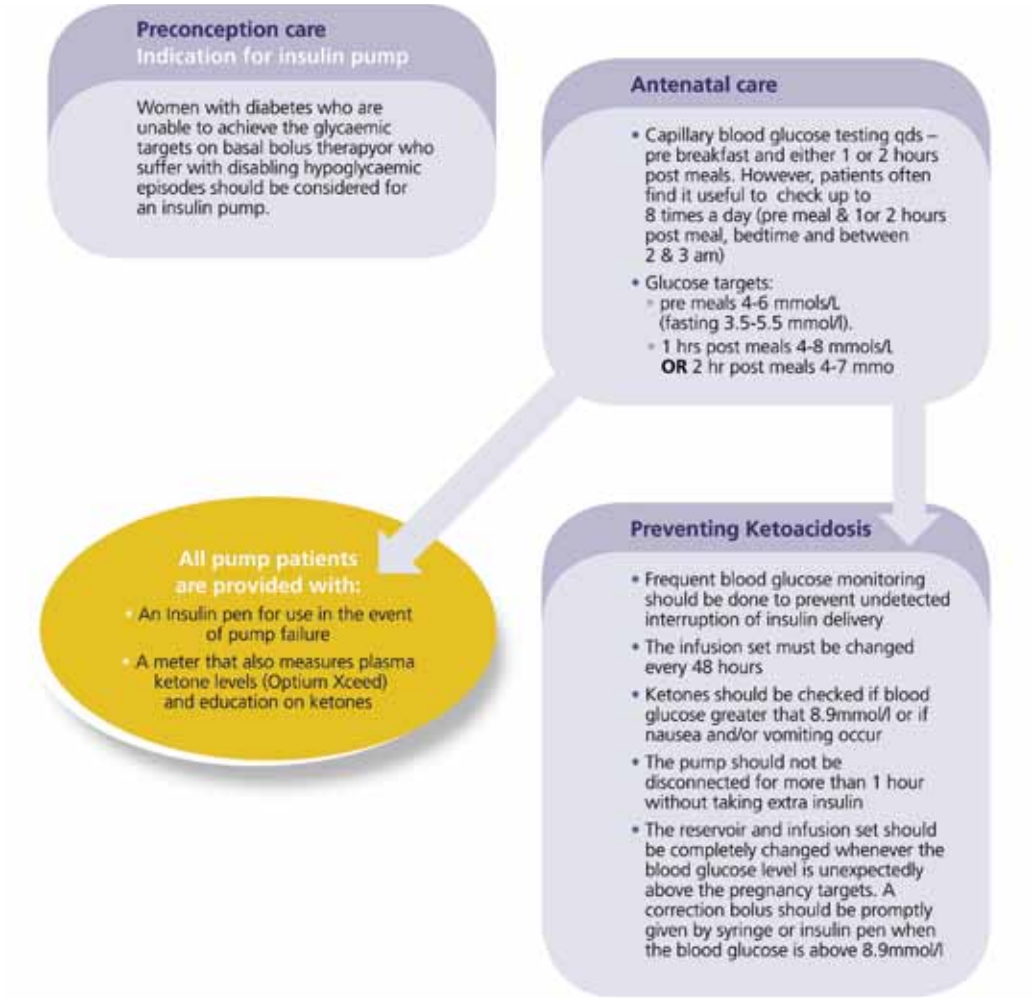
Low Risk

Low risk status, which does not require GDM screening, is defined as women with ALL of the following characteristics:

- Age <25 years
- Weight normal before pregnancy (BMI </= 25)
- Caucasian
- No known diabetes in first-degree relatives
- No history of abnormal glucose tolerance
- No history of poor obstetrical outcome.

Appendix 11

Insulin pump treatment in pregnancy (preconception and antenatal care)



Insulin pump treatment in pregnancy (delivery)

Atlantic DIP Guidelines, Edition 3, Aug 2015

Appendix 13

Details of Clinics and Referral Arrangements

- Patients with pre-existing diabetes (Type1, Type2, MODY tc) and with gestational diabetes should all be referred to the multidisciplinary diabetes antenatal clinic, booking with the Consultant Obstetrician who participates in this clinic. If a patient is referred very early and there is no hurry for the first antenatal clinic appointment they should be referred immediately to the diabetes services.
- Patients who are diagnosed with Gestational Diabetes Mellitus (GDM) during their pregnancy must immediately be referred to the Diabetes Team.

- The diabetes referrals can be made by the midwives or junior doctors to the Diabetes Specialist Nurse (DSN). DSN will assess the patients and discuss them with the diabetologist with responsibility for pregnant diabetic women and arrange early diabetes reviews as and when required. Many centres now have diabetes trained midwives who will take on this role instead.
- Patients with GDM who need insulin treatment should be referred to the obstetrician leading the diabetes antenatal clinic, those who are controlled on diet alone may be referred or alternatively, in some centres, would stay under the care of their original obstetrician, with visits to the DSN for their diabetes advice.
- For patients with GDM, repeat OGTT is booked at 6-12 weeks postnatal by the Diabetes Specialist Midwife or DSN. The results will be checked and communicated to the patient and their GP.

Appendix 14

Details of Clinics and Referral Arrangements

Local and national contacts

Galway

Galway University Hospital
Newcastle Road
Galway

Ms Louise Carmody
ATLANTIC-DIP Pregnancy
Services Coordinator
Diabetes Day Centre
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Endocrinology & Diabetes Day Centre
Galway University Hospital

Tel: Help Line: 091-544698

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Specialist Registrar/Research Fellow
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Professor Fidelma Dunne
ATLANTIC DIP Principal Investigator
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Diabetes Day Centre
Galway University Hospital
Galway

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Ballinasloe

Portiuncla Hospital
Ballinasloe
Co Galway

Consultant Endocrinologist
Portiuncla Hospital
Ballinasloe, Co Galway

Appendix 14

Details of Clinics and Referral Arrangements (continued)

Local and national contacts (continued)

Castlebar

Mayo General Hospital

Castlebar
Co Mayo

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