

Clinical Practices

FINAL DRAFT



Guidelines for the Management of Diabetes in Pregnancy

Perinatal Institute in association with WANDA
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Introduction

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These guidelines are intended for the use of 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 clinical goal is that 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 outcomes are significantly worse, with perinatal mortality rate remaining 4 times higher and the incidence of congenital malformations remains twice the rate as for non-diabetic pregnancies (3.4 times higher for neural tube defects, 3.3 for congenital heart disease) (ref *CEMACH* 2003/4). In a recent CEMACH report 36% of deliveries were preterm and the Caesarean rate was 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).

These risks apply equally to women with type 1 and type 2 diabetes. Women with type 2 diabetes now account for 40% of all pregestational diabetic pregnancies in the West Midlands and there are issues around awareness and access to pre-pregnancy counselling for this group. Many of these pregestational type 2 diabetic pregnancies are in non-Caucasian women from areas of high social deprivation (*CEMACH* 2003/4).



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.

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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 non-diabetic 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. These protocols represent locally adapted reviews of national guidance.

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 etiology 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.

Preconceptual Care

PATIENTS WITH ESTABLISHED TYPE 1 AND TYPE 2 DIABETES

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Pregnancy in a patient with preexisting type 1 or type 2 diabetes is often referred to in the obstetric literature as 'pre-gestational diabetes'. It occurs in approximately 3.5 per 1000 pregnancies. These are a high-risk group of patients that continue to have poorer fetal outcome, principally due to congenital malformations.

Women of childbearing age with diabetes should receive preconceptual care. The Diabetes NSF stated that 'A preconception clinic should be run jointly by the adult diabetes services and the maternity service for women wishing to become pregnant. Pre-pregnancy care outlined below should be part of their routine diabetes care whatever the setting.

The role of the 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. The following issues need to be addressed in all women with diabetes planning a pregnancy.

Another WANDA document – [Preconception Clinic Guidelines](#) gives more detailed guidance on issues relating to preconceptual care.

Risks of the Diabetic pregnancy

Risks to the mother

- Miscarriage
- Hypoglycaemia/Hyperglycaemia
- Ketoacidosis • IOL
- Caesarian section
- Retinopathy
- Hypertension/pre-eclampsia
- Nephropathy • Future diabetes

Risks to fetus

- Miscarriage
- Still birth/neonatal death
- Premature delivery (spontaneous or iatrogenic)
- Birth trauma to mother and baby
- Neonatal hypoglycaemia
- Neonatal polycythaemia
- Neonatal hypocalcaemia
- Ketoacidosis
- Neonatal hyperbilirubinaemia
- Neonatal cardiomyopathy
- Fetal macrosomia
- Birth trauma
- Congenital Malformation
- Future obesity and diabetes

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Risk of Diabetes to Offspring

If the mother has type 1 diabetes the risk of the child developing 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 emphasised during each and every diabetes review in all women of child bearing potential, wherever they are managed. Every opportunity should be taken to promote the need for preconceptual counselling at community diabetes or other health care related events and contact details for the local diabetes preconceptual counselling clinics given.

All women with diabetes should have a planned pregnancy and intensive preparation should ideally begin 3 to 6 months before the desired time of conception. Contraception should be continued until HbA1c has been optimised.

The patient 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

Patients 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.), ([Fuhrmann et al](#), 1983, [Kitzmilller et al](#), 1991, W. Mids. Confidential Enquiry). Insulin should be adjusted to obtain an HbA1c as near to the normal range as possible (< 6.5%). For those already on insulin the regimen should be reviewed with respect to its suitability and flexibility for changes during pregnancy. Patients with type 2 diabetes on oral hypoglycaemic agent should have a full medication review in order to facilitate appropriate changes concerning drugs not licensed in pregnancy, and/or contraindicated (see below), plus for conversion onto insulin treatment.

Patients should be offered rapid-acting insulin analogue and isophane as first choice during pregnancy although women may wish to remain on their pre-existing regime.

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

Preconceptual Care

PATIENTS WITH ESTABLISHED TYPE 1 AND TYPE 2 DIABETES

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Glucose monitoring

Glucose monitoring technique and frequency should be reviewed and an up to date meter should be provided. For women with Type 1 diabetes plasma or urinary ketone testing should be taught/ reviewed.

Hypoglycaemic Management

Patient should be educated in the self-management of hypoglycaemia and should be provided with glucagel and glucogen and appropriate training.

Review of medications

Additional treatments should be reviewed and discontinued where indicated. Patients on ACE inhibitors should have the reason for this medication reviewed (hypertension, micro- or macroalbuminuria) and alternative antihypertensive agents substituted. Lipid-lowering therapy should be stopped prior to conception due to its potentially teratogenic effects. Glucagon prescription should be considered.

Statins and ACE-I agent must be stopped prior to 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 (Nutrition Subcommittee of the British Diabetic Association's Profession Advisory Committee 1992). Education on formal carbohydrate counting may be offered. Obesity is an independent risk factor for adverse perinatal outcomes and patients should receive specific advice on weight loss prior to conception.

All patients should see a dietician early in the pregnancy. For overweight patients with type 2 diabetes, special attention needs to be given to portion size.

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).

Folic Acid Supplementation

All women with diabetes who are prescribed 5mg folic acid daily (folic acid is not available over the counter at this strength), continuing up to 12 weeks gestation (*Wald et al*, 2001).

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Screening for complications:

Nephropathy and Hypertension

There is an association between pre-existing nephropathy and a poorer pregnancy outcome. 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. Patients with Creatinine of $> 120\text{mmol/l}$ (or eGFR of $< 45\text{mls/min}$) or Protein excretion of $> 2\text{g/24hrs}$ should have nephrology review as soon as they are identified. Aspirin should be offered to women with a protein excretion of $> 5\text{g/24}$.

Retinopathy

Retinal photography should be offered at their first preconception visit. Women with significant retinopathy should be advised to defer rapid optimisation of glycaemic control and to defer pregnancy until retinopathy is treated. Patients with active retinopathy should be under the care of an ophthalmologist.

Additional Blood Tests

- Thyroid function and thyroid antibodies - optional.
- Rubella antibodies should be measured where rubella status is unknown.



Smoking cessation

All patients planning pregnancy who smoke should be advised with respect to smoking cessation. Occasional patients may also need referral for alcohol or drugs counseling.

Gestational Diabetes Mellitus

GDM

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In the current WHO Classification, GDM replaces the older categories of 'Diabetes in pregnancy' and 'Impaired Glucose Tolerance (IGT)' and the more recently defined category of Impaired Fasting Glucose (IFG).

It encompasses any degree of glucose intolerance i.e. IGT, IFG and frank diabetes, as long as the onset or first recognition is during the pregnancy. Typically, GDM has been a disorder of mild and transient glucose intolerance limited to the second half of pregnancy. However, 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.

Fasting	Plasma venous glucose after 75g GTT
> 6.1mmol/l	> 7.8 mmol/l

Table 1
West Midland Consensus Guidelines

GDM is also associated with increased fetal and maternal morbidity and fetal mortality particularly from macrosomia and occasionally from fetal hypoglycaemia (*Crowther et al* 2005, *Schmidt et al*, 2001). Targets for glycaemic control in these women should be as aggressive as for those with established, pregestational diabetes. First line treatment is diet together with insulin and/or Metformin* as required (Rowan et al 2008). Glibenclamide* may be considered for those who have difficulty with insulin therapy (NICE 2008).

A diagnosis of GDM also identifies women at increased risk of developing type 2 diabetes in future (*O'Sullivan et al*, 1989).

* These drugs are not licensed in pregnancy and informed consent should be obtained.

Screening for Gestational Diabetes

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

NICE Guidelines 2008, recommend that at risk women are offered an OGTT at 24-28 weeks. Women with previous GDM should be offered early self-monitoring blood glucose or an OGTT at 16-18 weeks, repeated at 28 weeks if normal.

In the West Midlands (DIPAG), we recognise there are substantial numbers of women with undiagnosed pre-existing diabetes.

We therefore recommend to continue screening for glycosuria throughout pregnancy and to offer random plasma glucose to women of higher risk (see table).

Screening for patients with previous gestational diabetes is traditionally by GTT at 16 weeks, repeated at 28 weeks if the first is negative. In practice these patients will usually initiate home glucose monitoring at an early stage and many may have a decision as to treatment based on these results without the need for a GTT during the pregnancy.

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Screening for Gestational Diabetes

The following patients should be screened for gestational diabetes:

At 24-28 weeks

- First degree relative with diabetes (any type)
- Body mass index >30 kg/m²
- Maternal age > 35 years
- Ethnic minority – South Asian, Middle Eastern, Afro Caribbean, African
- Polycystic ovary syndrome
- Long term steroids
- Previous unexplained stillbirth or recurrent miscarriage
- Previous history of macrosomia (birth weight >4.5 kg or > 90th centile for gestation {on customised growth chart if available})
- Polyhydramnios or fetal macrosomia in current pregnancy (> 90th centile on customised growth chart)
- Previous GDM (if normal at 16-18 weeks)

Early screening

- Previous history of gestational diabetes should have a glucose tolerance test arranged for 16-18 weeks with a repeat at 28 weeks if the first is normal.

Immediate screening

- Glycosuria (++) or above
- Urgent blood glucose and capillary ketones if significant ketonuria (++) and glycosuria

NB

- Remember type 1 diabetes in pregnancy.

Features suggesting Type 1 Diabetes

- 1) Rapid onset symptoms
- 2) Significant weight loss
- 3) Ketonuria
- 4) Other auto-immune disease

Screening for GDM by stepped approach

Some units may consider a stepped screening approach before phasing in NICE screening:

1. Timed laboratory plasma glucose at booking and again at 26 weeks: and stat if glycosuria.
2. If fasting blood >5.0 or 1-2 hours post-meal >6.0 , proceed to GTT (at any stage of pregnancy).

Late presentation of at risk women up to 30-40, limited data suggests a GTT should be performed. After 30/40 offer random blood glucose monitoring, if >6.0 mmol/l then implement strict HBCM and diet.

Patients must be booked for antenatal care as soon as they know that they are pregnant. All patients with pregestational diabetes of any type 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

Target Glucose levels

Aim for:

- Fasting glucose 3.5-5.5 mmol/l
- Before meal glucose 4.6-6.0 mmol/l
- After meal glucose <8 mmol/l

Target HbA1c levels

- Aim for HbA1c at least $<6.5\%$ (preferably $<6\%$ unless this cannot be achieved without hypoglycaemia). HbA1c is checked at booking visit and repeated every 4-6 weeks.

Self-monitoring of blood glucose

Women should check blood glucose at least four times per day (fasting, pre or post-meal and at bedtime, depending on their individual insulin regimen) and be taught how to use this information in order to achieve target blood glucose levels. In certain circumstances a '7-point profile' (pre and post meal and bedtime), a night-time glucose check (3am), or continuous glucose monitoring may be useful (e.g. suspected nocturnal hypoglycaemia).

Achieving Target Glucose Levels

A basal-bolus (multiple daily injection, MDI) regimen is usually recommended and women should be taught how to safely adjust insulin doses according to carbohydrate counting principles and results of self-glucose monitoring. Frequent telephone contact is usually required, with the majority of women needing intensive support to facilitate dose adjustment. Many centres now offer Continuous subcutaneous infusion of insulin (CSII, insulin pump therapy) as an option for women who cannot reach glycaemic targets during (or before) pregnancy, or who develop hypoglycaemia. Guidelines for patients on CSII are given in appendices 10 and 11.

FASTING	1HR POST-PRANDIAL
3.5 - 5.9	<7.8

Glucose Targets



Ketoacidosis

Women with type 1 diabetes are more susceptible to developing ketoacidosis during pregnancy. All pregnant women with pre existing diabetes are instructed to test for urinary or plasma ketones if:

- Glucose > 12mmol/l
- They are unwell, especially if vomiting, irrespective of the glucose value (ketoacidosis with normal glucose values is well recognised in pregnancy).

Women are taught that if results indicate likely ketoacidosis they should immediately seek emergency medical assessment and treatment at their local hospital as there is a high risk of pregnancy loss in the presence of ketoacidosis. There should be a low threshold for admission to hospital in patients who may be developing this. If ketoacidosis is confirmed then intensive management is indicated and will involve much more than just the prescription of a sliding scale (see local guidelines). The consultant obstetrician should be informed and medical help requested.

If women are are unwell or vomiting with raised ketones then they should self-refer to hospital.

BLOOD KETONE (MMOL/L) READING

< 0.6	0.6 - 1.0	>1.0
Normal	Self-management if other wise well Follow SICK DAY RULES	Self-refer to hospital

Treat DKA as per hospital protocol (Senior Ohs and Diabetologist (regular & above).

Nutrition

See pre-conception page.

Vomiting

Patients with nausea and vomiting should be given advice on adequate fluid intake, regular small portions, sickday rules and frequent monitoring. Plasma ketones should be measured and there should be a low threshold for admission. Women with severe nausea of pregnancy should be treated with antiemetics and those with severe vomiting hospitalised promptly.

Hypoglycaemia

All patients should be taught how to avoid and manage hypoglycaemia. All women at risk of hypo should offered glucagel and a glucagon kit and taught how to use it.

Complications, screening and monitoring

Nephropathy and Hypertension

There is an association between pre-existing 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 with normal urinary albumin excretion (ACR) prior to pregnancy do not need to have this test repeated during pregnancy (transient pregnancy associated abnormalities are common, if found consistently this could be a marker for pre-eclampsia).

All women with nephropathy will need close monitoring prior to and during pregnancy. Monitoring may be by morning sample for albumin/creatinine ratio, 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.

Initiate anti-hypertensive therapy if
BP > 140/90 at any stage of pregnancy
or
2g/24 hr proteinuria irrespective of BP

Target BP 130/80
1) Methyldopa
2) Labetalol or Calcium Channel Blockers

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, nifedipine and diltiazem according to patient's preference, stage of pregnancy and local pregnancy guidelines.

Retinopathy

Retinopathy may progress during pregnancy (*Axer-Siegel et al*, 1996). Screening should be offered at booking and 28 weeks. If retinopathy is present further screening should be offered at 16 and 20 weeks. More frequent assessment may be required in those with poor glycaemic control or hypertension as these factors are independently associated with progression of retinopathy (*Rosenn et al*, 1992). Early referral of patients with moderate retinopathy to an ophthalmologist is recommended due to the potential for rapid development of neovascularisation. The presence of retinopathy should not deter optimising diabetic control.

Aspirin

There is insufficient evidence to currently recommend the routine use of aspirin in pregnancy. It may currently be considered in patients 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 patients with an inherited or acquired thrombophilia or patients with proteinuria in the nephrotic range.

Obstetric Management

- A dating ultrasound scan is performed at 7-9 weeks to accurately date the pregnancy.
- Screening for Downs Syndrome and neural tube defects should be offered according to local protocols.
- 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, 32 and 36 weeks with more frequent scans where clinically indicated.
- Different methods of fetal monitoring from 34 weeks gestation should be employed including the use of CTGs, ultrasonic evaluation of fetal liquor volume and umbilical artery dopplers. There is evidence from the WM inquiry that the absence of fetal monitoring is associated with a poorer perinatal outcome.



- 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.

Timing and mode of delivery

Late fetal loss is a particular concern in pregnancies complicated by diabetes. Routine induction or delivery before 38-40 weeks is not recommended.

The timing and mode of delivery is an individualised decision agreed between the patient and her obstetrician and should be clearly documented.

The risks of stillbirth need to be balanced against the risks of failed induction of labour (IOL). Women with pre-gestational diabetes should be delivered between 38-40 weeks. Some women with diet-controlled GDM may wait for spontaneous labour up to 41-40 weeks.

Women should be given advice regarding risks/benefits of mode of delivery.

The timing and mode of delivery needs detailed discussion with the patient and MUST involve Senior Obstetric input. The risk of stillbirth needs to be balanced against the risks of induction of labour (IOL) at 38-40 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 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.

The individual birth plan wishes of the patient 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.

Gestational Diabetes

Those on diet and low dose insulin 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 mmol/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.

(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).

Type 1 and type 2 Diabetes

An individualised care plan for glycaemic control in labour should be drawn up when plans for delivery are made.

Spontaneous Labour

Once labour is established an insulin sliding scale should be commenced. Patients 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/l. This will help prevent neonatal hypoglycaemia.

BLOOD GLUCOSE (BG) INSULIN RATE/HR (mls/h)

< 4 or less	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.

** For glucoses < 4.0 mmol/l stop infusion for 15 minutes and treat hypoglycaemia, 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

- 1000ml 5% glucose with 20mmol Potassium Chloride (KCl)
- Run at 100 ml/hr using drip regular (eg IVAC/IMED pump)

Insulin Infusion

- Make up 50units 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 dextrose infusion.



Management During Labour

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Insulin sliding scale cont

If glucose is running > 10 mmol/l or if the patient is unwell, check for ketones (euglycaemic ketoacidosis is recognized to occur in pregnancy).

If glucose is running below 4 or above 7 over two successive hours adjust rate of insulin infusion (insulin rate/hr) prescribed by sliding scale.

Patients on >80 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 with appropriate potassium supplementation. 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 more frequently if the blood glucose is outside the desired range or if the patient is "ill".



Insulin Pumps

See Appendix 1 guides 10 and 11.
Check against local pump protocol.

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Caesarian Section and Induction of Labour

Caesarean Section

Commence a glucose and insulin infusion.

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

Intravenous antibiotics should be given prophylactically according to local practice.

Induction of Labour

Individual trust guidelines will vary but generally all diabetic women being admitted for induction of labour will be admitted the evening prior to induction. 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 (MID – 0025).

Delivery

The Consultant Obstetrician or Registrar must be easily accessible for delivery should there be suspicion of foetal macrosomia. The Paediatrician must be available.

Type 1 and Type 2 Diabetes

After the placenta has been delivered, rate 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 regimen, 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).
- Patients 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 patients.

Blood glucose monitoring should be continued for 48 hours post delivery. If all values are below 6 preprandially and below 9 postprandially the patient may discontinue testing. If above this level please request the advice of the diabetes team prior to discharge.

Women should be made aware of the possibility of developing permanent diabetes and given advice.

Hypertensive Disease

Where a diabetic woman 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.

Pre-term Labour

Tocolytics such as atosiban 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.

Atosiban and Ritodrine 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 patient is nil by mouth, then they should also be commenced on 5% Glucose infusion. However, if they are eating and drinking, then they should be given the insulin on its own.

Steroids

Diabetes is not a contraindication for steroid use. Infants of diabetic mothers are, in fact, at increased risk of RDS 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 must 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 with a potassium component should be commenced at the same time. A sliding scale insulin regimen may need to be continued for up to 24 hours after 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, in which case the insulin infusion rate for glucose levels below 4 mmol/l should be adjusted to 0 units/hr.



Previously a few selected patients may have been managed as outpatients with a temporary increase in insulin doses of 10-25% Following the recent West Midlands Confidential enquiry reports this practice should no longer be recommended.

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

Follow-up should be arranged at 6 weeks for a postnatal examination. For those with gestational diabetes a glucose tolerance test should be arranged for the day of, or the few days prior, to the clinic. Local audits confirm a high incidence of post-natal diabetes (up to 2-3%) and IGT of ~10%. We recommend women continue to be offered post-natal GTT. Opportunity should be taken at this stage to give pre-pregnancy advice for next pregnancy.

A diabetic clinic appointment, if previously under hospital care, for 3 months with the Consultant Diabetologist who looked after them prior to pregnancy should also be arranged through the DNS or diabetes secretaries.

Patient with gestational diabetes should return to GP care after receiving appropriate dietary and lifestyle advice. The GP should be informed of the result of the GTT with a request for an diabetes clinic appointment if the postnatal OGTT confirms diabetes (this is rare). Annual GTT is recommended for those with persistent IGT or IFG postnatally and annual screen with either GTT or fasting and postprandial glucose measurement in the event of normalisation of the postnatal GTT.

Patients planning another pregnancy within one year should be rebooked for the prepregnancy clinic at an appropriate interval.



Babies should remain with their mothers during the neonatal period unless there is a specific medical indication for admission to the neonatal unit. A quarter to a third of all babies admissions to a neonatal unit could be avoided by establishment of early feeding and experienced midwifery care.

Breastfeeding is of established benefit in maintaining stable neonatal blood sugar levels and in establishing normal metabolic adaptation and should be strongly promoted. Babies born to women with diabetes should be fed as soon as possible after birth and certainly within 4 hours of birth unless contraindicated for medical reasons. Mothers of babies admitted to the neonatal unit should be encouraged and helped by midwives and neonatal staff to express breastmilk as this can be given on the neonatal unit. It is more beneficial, especially in premature babies, than formula milk.

Neonatal blood testing is necessary to try and prevent significant neonatal hypoglycaemia, however, testing too early after delivery (within 1 hour) is only likely to uncover the physiological fall in glucose after birth leading to unnecessary intervention and neonatal ward admission.

In a well baby displaying normal observations and activity a test of blood glucose concentration should be performed within 2-4 hours of age, or 30-60 minutes after a feed (see guideline number 7 for management according to blood glucose level). Glucose reagent strips are contraindicated in neonates as they may be inaccurate in this situation. An accurate laboratory or ward based measurement should be performed to exclude neonatal hypoglycaemia.

Each obstetric unit should have midwives experienced in the post-natal management of maternal diabetes and of babies at risk of hypoglycaemia. Prevention of separation of mother and baby for isolated and transient hypoglycaemia in an otherwise well baby while being able to recognize the unwell baby who needs neonatal medical input, is a key element of the care for these babies.

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Appendix 1

Flow charts for use in clinic setting and for inclusion in patents notes

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Diabetic Antenatal Care - No.1

Pregestational diabetes

1st Visit

- Bloods – HbA1c, U&Es, Urine for microalbuminuria
- Folic Acid 5mgs
- Accurate Medical + Obstetric history
- Medication – STOP Statins, Diuretics, ACE Inhibitors.
- If on Oral Hypoglycaemic Agents transfer to Insulin
- Full assessment of glucose control and adjustments made
- Glucose Targets: pre-meals 4-6 mmols/L (fasting 3.5-5.5) 1hr post meal < 8mmol/l OR 2hrs post meals <7 mmols/L
- BP + Urinalysis for Protein/ Ketones
- Scan arranged for 7-9 wks gestation to confirm viability.
- Fundal screening for retinopathy
- Hypostop/ Glucagon/ instructions for treatment of hypoglycaemia
- Dietetic Advice low fat / sugar high fibre
- Smoking cessation
- Check glucose meter, check ketone testing
- Review sick day rules

Pregestational diabetes Up to 20 wks

- Formal dating scan (at 11-14 weeks)
- Pregnancy booking bloods
- Review of glycaemic targets
- 4 weekly HbA1c + RBS

Gestational Diabetes 1st Visit

- Shown self blood glucose monitoring
- Bloods HbA1c, U&Es
- Dietetic Advice low fat/ sugar high fibre
- Follow guidelines at appropriate gestation

Pregestational diabetes

20 - 34 wks

- 2 wks visits or tailored to patient needs
- Scans – Detailed fetal and cardiac scan at 20 weeks, Fetal growth at 28 weeks.
- Bloods – 4wksly HbA1c + RBS
- Retinal screening each trimester (or ophthalmologist review)
- Prompt diagnosis & treatment of: raised BP/ Pre-eclampsia/ urine and vaginal infections
- Ketoacidosis requires admission

Gestational diabetes 28-34 wks

- 2 weekly visits tailored to individual needs
- Growth scans, bloods and screening for bp/Pre-Eclampsia as above

20 - 34 wks

- 1-2 weekly visits
- Close monitoring of fetal movements
- Weekly assessment of fetal wellbeingeg liquor vol + umbilical artery Doppler scan/ CTGs
- Growth scans at 34 wks then as needed
- 4 weekly HbA1c
- Prompt diagnosis & treatment of: ketoacidosis /raised BP/pre-eclampsia / urine and vaginal Infections
- Discuss delivery plan, involving Consultant Obstetrician with aim to deliver at < 40 wks.
- Obstetric anaesthetic review at 34 wks
- Plan glycaemic management during and after delivery

N.B. Regime may vary slightly for each person

WANDA guidelines No:1. Version 2. Dated Jan 07.

Diabetic Intrapartum Care - No.2

33

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 + Dextrose regime
 - Glucagon (Type 1 diabetes)
 - Post delivery Insulin regime
- Aim to keep glucoses between 4 – 7mmols/L (Commence Sliding scale Insulin + Dextrose 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 + Dextrose 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.
- Routine bloods. FBC. G&S. + pre – op procedure
- Inform Delivery suite of her admission.
- **DO NOT ALLOW TO GO HOME**
- Prescribe:
 - Sliding scale Insulin + Dextrose
 - Post delivery Insulin regime
 - Glucagon 1 mg (Type 1 diabetes)
- **N.B.M. from midnight.**
- Treat hypoglycaemia with Dextrose Tabs x 3 or Glucogel then transfer to Delivery suite for Sliding scale Insulin + Dextrose

Following morning

- Omit morning dose of insulin.
- Listen to the fetal heart.
- **Transfer to Delivery suite 07.00 - 08.00 hrs**
- **Commence IV Sliding scale Insulin + Dextrose as per protocol**

Gestational Diabetes

- Stop Infusion once placenta delivered

When and how to stop a sliding scale insulin post delivery

Pre pregnancy Diabetes

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

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

WANDA guidelines No:2. Version 2. Dated Jan 07.

Appendix 1

Flow charts for use in clinic setting and for inclusion in patents notes

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Preterm Labour for women with diabetes - No.3

Sliding scale insulin regime - No.4

35

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 Dextrose 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 SCBU of admission

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.

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 + Dextrose is given via the same venflon using a 'Y' connector

Insulin Regime

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

If NBM you must give

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

Blood Glucose (mmols/L)

Insulin Infusion Rate mls/hr

< 4 or less **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

Gestational Diabetes

- Stop Infusion once placenta delivered

When and how to stop a sliding scale insulin post delivery

Pre pregnancy Diabetes

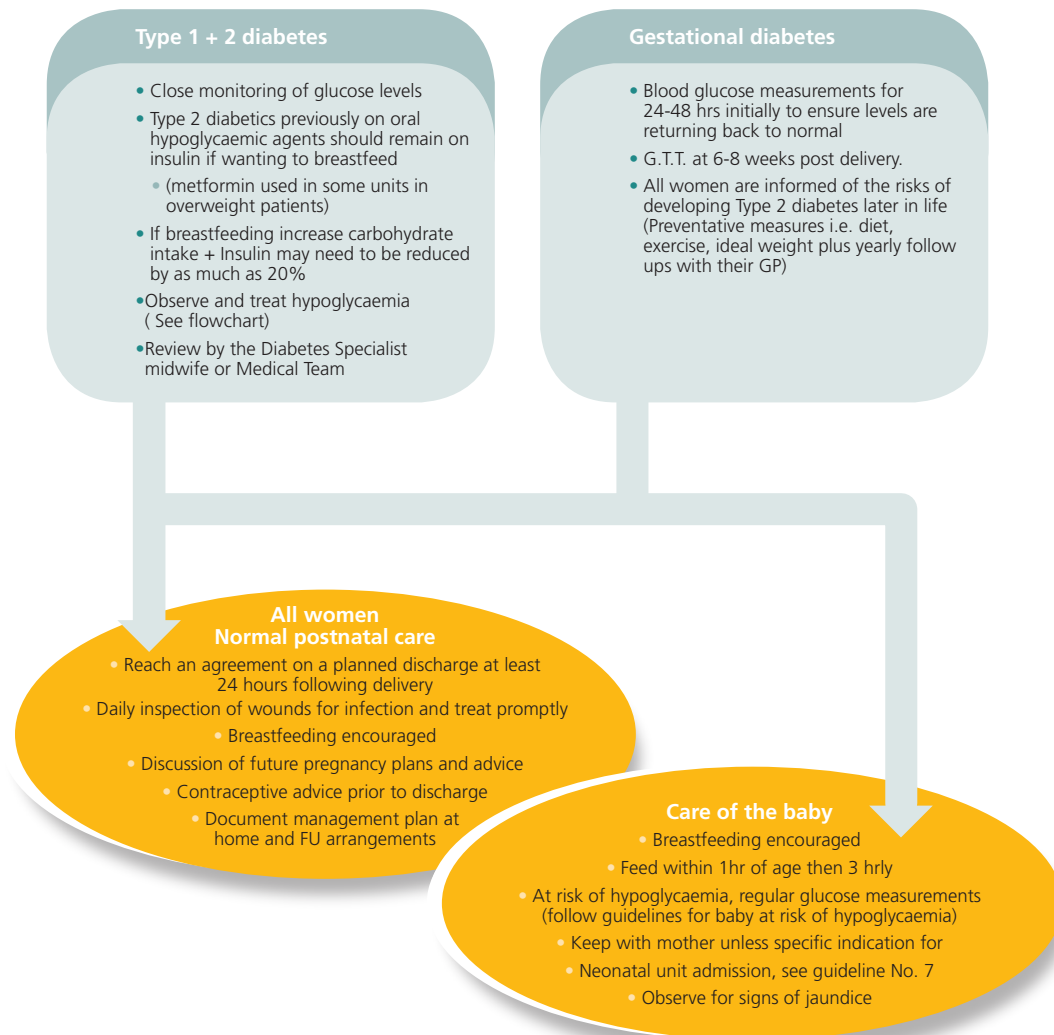
- Ensure patient is eating and drinking normally
- Give Insulin when next due. (Regime in notes)
 - Provide meal or snack.
- Stop Insulin + Dextrose after 30 mins

Appendix 1

Flow charts for use in clinic setting and for inclusion in patents notes

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Postnatal care for diabetes - No.5



Prepregnancy advice for diabetes - No.6

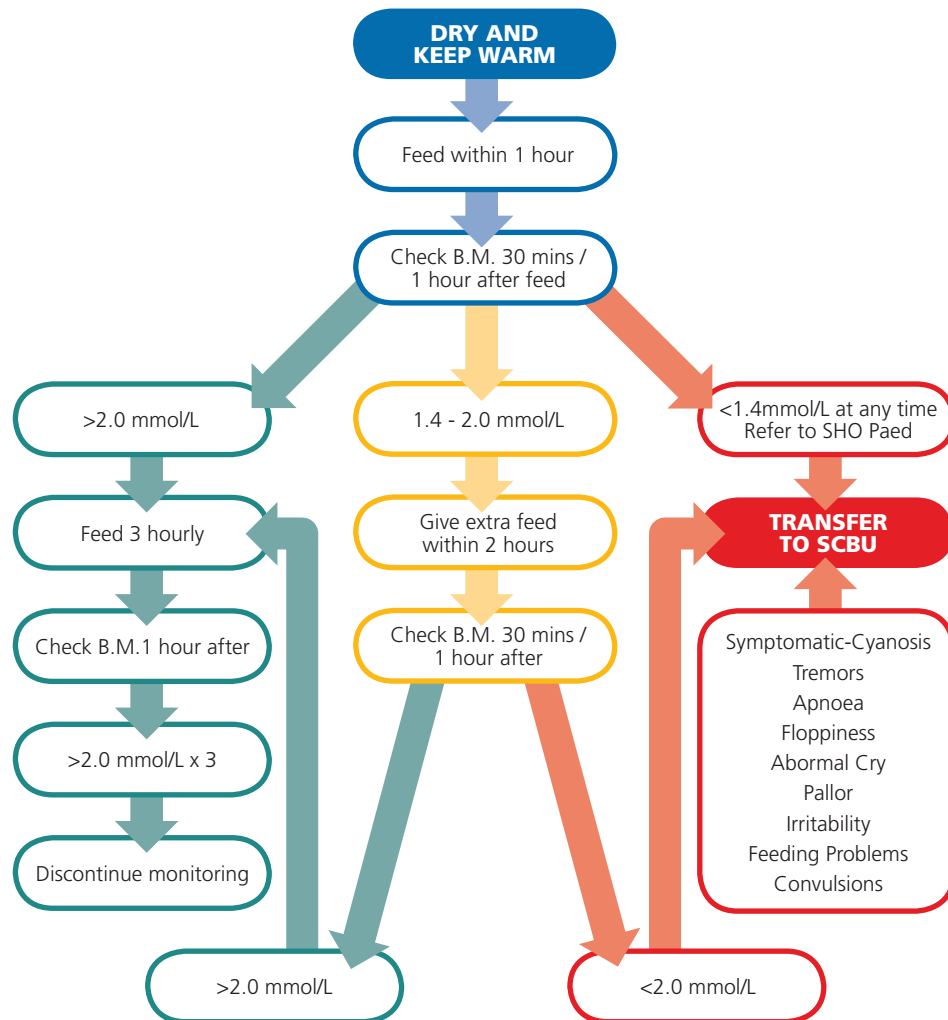
37



Appendix 1

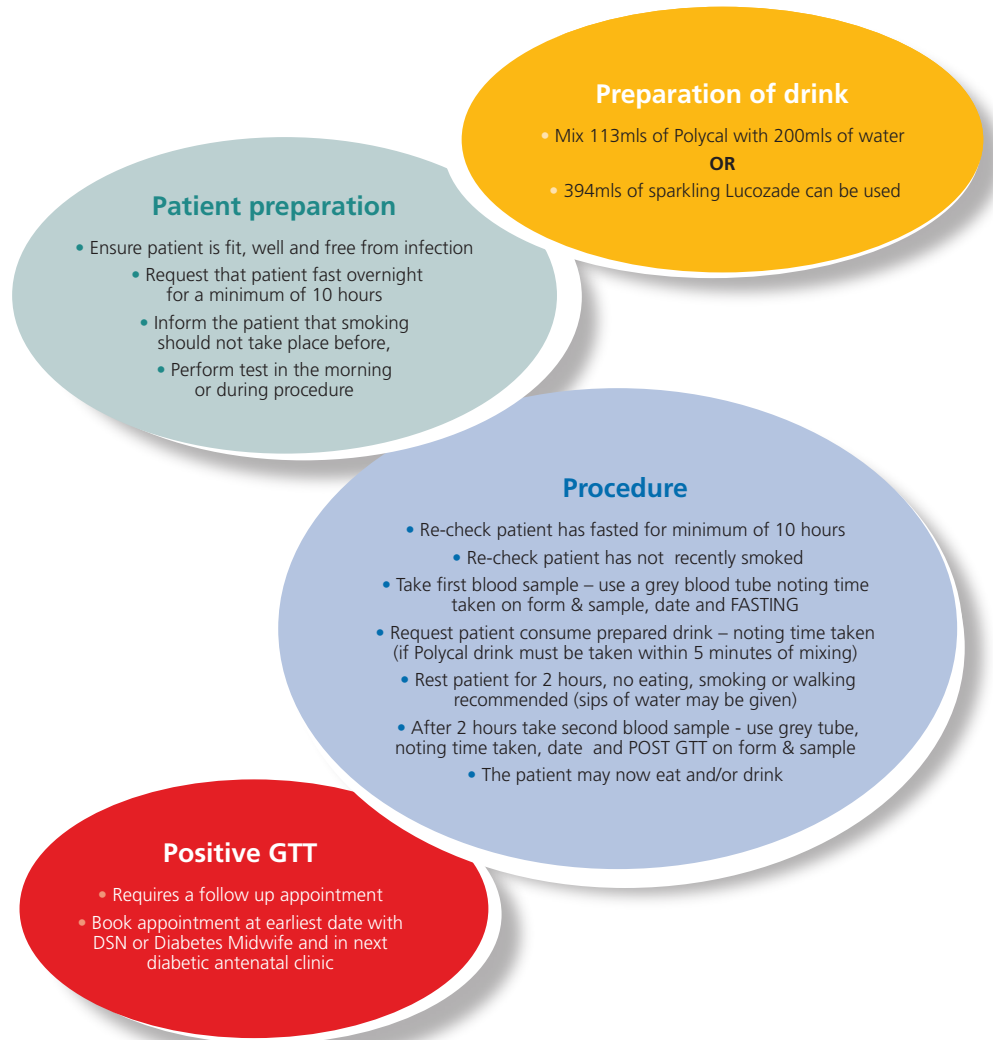
Flow charts for use in clinic setting and for inclusion in patents notes

38 Treatment of an infant at risk of hypoglycaemia - No.7



Procedure for performing a glucose tolerance test - No.8

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Appendix 1

Flow charts for use in clinic setting and for inclusion in patents notes

40 Screening for gestational diabetes (Two step process) - No.9

High risk of gestational diabetes:
Screen at booking or 16 weeks and repeat at 28 weeks if negative by the two-step process

- First degree relative with diabetes (any type)
- Body mass index >35 kg/m²
- Maternal age > 35 years
- Ethnic minority – South Asian, Afro Caribbean, African
- Polycystic ovary syndrome
- Long term steroids
- Previous unexplained stillbirth
- Previous history of macrosomia (birth weight >4.5 kg or > 90th centile for gestation)
- Polyhydramnios or fetal macrosomia in current pregnancy (> 90th centile)

- Urinalysis for glucose **each** antenatal visit
- Glycosuria ++ or above on two occasions or +++ on a single occasion

- Previous history of gestational diabetes
- **Screen at booking and repeat at 28 weeks if negative by the two-step process**

Two step process

Fasting or random blood glucose

> 7mmol/L fasting
>11mmol/L random

= Diabetes
Check urine for ketones

Refer urgently to diabetes care team If ketones present, patient should be seen by the diabetes team (DSN) the same day

<5mmol/L fasting
<6 within 1-2 hours of proper meal
= Normal

>5mmol/L fasting
>6mmol/L within 1-2 hours of a proper meal
= Needs OGTT

Insulin pump treatment in pregnancy - No.10 (preconception and antenatal care)

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Preconception care

Indication for insulin pump

Women with diabetes who are unable to achieve the glycaemic targets on basal bolus therapy or who suffer with disabling hypoglycaemic episodes should be considered for an insulin pump.

Antenatal care

- Capillary blood glucose testing qds – pre breakfast and either 1 or 2 hours post meals. However, patients often find it useful to check up to 8 times a day (pre meal & 1 or 2 hours post meal, bedtime and between 2 & 3 am)
- Glucose targets:
 - pre meals 4-6 mmol/L (fasting 3.5-5.5 mmol/L).
 - 1 hrs post meals 4-8 mmol/L **OR** 2 hr post meals 4-7 mmol/L

All pump patients are provided with:

- An Insulin pen for use in the event of pump failure
- A meter that also measures plasma ketone levels (Optium Xceed) and education on ketones

Preventing Ketoacidosis

- Frequent blood glucose monitoring should be done to prevent undetected interruption of insulin delivery
- The infusion set must be changed every 48 hours
- Ketones should be checked if blood glucose greater than 8.9mmol/L or if nausea and/or vomiting occur
- The pump should not be disconnected for more than 1 hour without taking extra insulin
- The reservoir and infusion set should be completely changed whenever the blood glucose level is unexpectedly above the pregnancy targets. A correction bolus should be promptly given by syringe or insulin pen when the blood glucose is above 8.9mmol/L

Intrapartum care:

Guidelines for the use of insulin pump during labour

If diabetes is stable, and patient or partner able to manage pump continue with pump therapy during labour

If problems arise, remove the pump and infusion set and revert to usual protocol (IV insulin sliding scale)

Before delivery

- Ensure midwifery staff knows that a pump is being worn
- If for LSCS inform surgeon, anaesthetist and theatre staff that a pump is being worn
- Ensure the CSII is situated at the lower end rib level near the back
- Avoid potential LSCS site and the area to be cleansed when positioning infusion set
- Ensure the pump has charged batteries, full reservoir/cartridge and new infusion set plus a spare set of each

During delivery

- If birthing pool is used, keep the pump out of the water. They are shower proof but avoid immersion in water
- Continue usual basal rate, aiming to keep blood glucose levels between 4 and 6 mmol/l. Measure blood glucose levels hourly and make corrections via the pump if blood glucose greater than 7 mmol/l. Use 1 unit of insulin to reduce blood glucose levels by 2.5 mmol unless the pump user states otherwise
- If correction bolus via pump ineffective switch to intravenous insulin (see above)
- At the start of the second stage, ask patient /partner to reduce basal rate by 60% or to pre pregnancy dose if known (may be preset)
- Consider inserting venflon

Postnatal care

- If stable offer tea & toast
- Monitor 2 hourly until stable
- If breast feeding basal rate may need lowering