Gestational Diabetes Mellitus Guideline

Guideline information

Guideline number: 1216
Classification: Clinical
Supersedes: Version 1.0
Local Safety Standard for Invasive Procedures (LOCSSIP) reference: N/A
National Safety Standards for Invasive Procedures (NatSSIPs) standards: N/A
Version number: 2.0
Date of Equality Impact Assessment: 22/05/2026

Approval information

Approved by: Medicines Management Formulary Group
Date of approval: 30/05/2026
Date made active: 02/06/2026
Review date: 30/05/2029

Summary of document:
Guidelines for management of Gestational Diabetes mellitus. The guideline provides guidance to all health professionals in the care provision for women and birthing people who develop diabetes in pregnancy within all locations of Hywel Dda University Health board.

Scope:
Designed to set out quality care guidelines for identification of GDM by screening and guidance on the management of women and birthing people who develop diabetes during pregnancy to support clinical decisions.
This policy uses the term “women” to reflect that maternity and reproductive care are sex-based health needs. It applies equally to all people who are pregnant or have recently given birth, including trans men and non-binary people. Care must be delivered in an inclusive, respectful and responsive way.

To be read in conjunction with:
Adult Diabetic ketoacidosis (DKA) care bundle
Neonatal hypoglycaemic guidance

Patient information:
Include links to Patient Information Library

Owning group:
Obstetric Written Documentation Review Group
30/05/2026

Executive Director job title:
Clinical Lead Obstetrician

Reviews and updates:
Version 1 - 24.08.2023

Keywords
Management of Gestational Diabetes Mellitus, Diabetes in Pregnancy

Glossary of terms
ANC - Antenatal Clinic
ARM - Artificial Rupture of Membranes
BG - Blood Glucose
BMI - Body Mass Index
CBG - Capillary Blood Glucose
CGM - Continuous Glucose Monitor
CTG - Cardiotocography
DKA - Diabetic Ketoacidosis
DSM - Diabetic Specialist Midwife
DSN - Diabetic Specialist Nurse
DVLA - Driver and Vehicle Licencing Agency
EDD - Estimated Due Date
EBM - Expressed Breast Milk
FBG - Fasting Blood Glucose
GDM - Gestational Diabetes Mellitus
GA - General Anaesthesia
GP - General Practitioner
IOL - Induction of Labour
IV - Intravenous
MLC - Midwife Led Care
MW - Midwife
OGTT - Oral Glucose Tolerance Test
PMOS - Polyendocrine metabolic Ovarian Syndrome
TSH - Thyroid Stimulating Hormone
U&E - Urea & electrolyte
VE - Vaginal Examination

Contents

Scope

Designed to set out quality care guidelines for identification of GDM by screening and guidance on the management of patients who develop diabetes during pregnancy to support clinical decisions.

Aim

The aim of this document is to:

- To provide guidance to all health professionals in the care provision of women with diabetes in pregnancy within all locations of Hywel Dda University Health board

Objectives

The aim of this document will be achieved by the following objectives:

- To identify GDM in patients with risk factors at booking, or where features of concern develop.
- To give optimum care to women with diabetes during pregnancy through monitoring of maternal and fetal well-being.
- To make appropriate decisions regarding timing and mode of birth, taking maternal preferences into account.
- To support management of glycaemic control when pregnant patients with diabetes are admitted to the obstetric unit.
- To offer support to patients regarding infant feeding choices and to reduce the incidence of neonatal hypoglycaemia.
- To advise and support the diabetes patient in making choices and decisions to optimise their long-term health.

Target Personnel

All staff involved in the care provision of diabetes in pregnancy within Hywel Dda University Health Board.

Introduction

The pregnancy of patients with diabetes is considered ‘high risk’ and therefore most of the antenatal care will be in the hospital setting. However, these patients should continue to receive routine care with their community midwife. Diabetes increases risks during and after pregnancy for mother, fetus and new-born. For this reason, this is a multidisciplinary document involving Obstetric, Diabetology, Neonatology and Midwifery staff. The incidence of GDM has increased in recent years and is considered a result of higher rates of obesity in the general population and increased pregnancies in older patients.

Diabetes in pregnancy is associated with risks to the patient and to the developing fetus-

- Pre-term birth
- Macrosomia
- Induction of labour or caesarean birth
- Birth trauma to mother and baby
- Stillbirth
- Pre-eclampsia
- Transient neonatal morbidity

- Neonatal death
- Obesity and/or diabetes developing later in the baby's life
- Diabetes developing after a diagnosis of GDM

Organisation of Antenatal Care Provision by Multidisciplinary Team

Patients with confirmed GDM should be offered contact with the multidisciplinary specialist team comprising of Consultant Obstetrician, Consultant Diabetologist, Diabetes Specialist Midwives (DSM), Diabetes Specialist Nurses (DSN) and Diabetes Specialist Dietician (DSD). DiabetesSpecialistMidwives.hdd@wales.nhs.uk

Screening for Gestational Diabetes Mellitus (GDM)

GDM is defined as any degree of glucose intolerance with the onset or first recognition during pregnancy. GDM occurs in a pregnant patient who does not already have diabetes, often developing in the 2nd trimester of pregnancy.

A progressive insulin resistance develops during pregnancy due to the effects of hormones produced by the placenta. The aim is to reduce the amount of glucose that is absorbed by the maternal cells so that the growing fetus has enough 'fuel' for development. GDM develops when pancreatic β cell function is not sufficient to overcome the increased insulin resistance. Following birth, we expect GDM to disappear.

Any pregnant patient can develop GDM but the chance of developing GDM is higher for some patients if they have certain risk factors.

Risk Assessment

At the booking appointment, a risk assessment for GDM should be carried out. If one or more of the following criteria are met, then testing for GDM should be offered.

- Previous history of GDM or history of Type 2 DM in remission/Pre-diabetes (These women require early GTT)
- BMI >30 kg/m^2 at booking.
- Maternal age of 40 and above **at booking**.
- Previous macrosomic baby weighing > 4.5kg or babies >97th centile of personalised growth chart
- • First degree relative with diabetes (sibling or parent)

• Family origin with a high prevalence of diabetes: South Asian (specifically women whose country of family origin is India, Pakistan or Bangladesh), Afro - Caribbean ,Middle Eastern (specifically women whose country of family origin is Saudi Arabia, United Arab Emirates, Iraq, Jordan, Syria, Oman, Qatar, Kuwait, Lebanon or Egypt)

- Polyendocrine metabolic ovarian syndrome (PMOS)
- Women on antipsychotic medications (see appendix 1.)
-

Midwife at viability/dating scan to book Oral Glucose Tolerance Test (OGTT) between 24 – 28 weeks in women with risk factors and provide an appointment invitation with information on having an OGTT (See appendix 2).

Certain risk factors for GDM may only become apparent during the pregnancy. Once identified the appropriate screening test should be undertaken within 5 working days irrespective of gestation if under 34 weeks gestation.

These factors include:

- Glycosuria of 2+ or more on 1 occasion **or** 1+ on 2 occasions
- Polyhydramnios (moderate/severe) (see criteria for mild, moderate and severe polyhydramnios) table below)

Criteria for mild, moderate, and severe polyhydramnios

	Mild	Moderate	Severe
Single deepest pocket	8.0 to 11.9 cm	12.0 to 15.9 cm	≥16.0 cm
Amniotic fluid index	24.0 to 29.9 cm	30.0 to 34.9 cm	≥35.0 cm

- Following ultrasound growth scan :
  - Fetal macrosomia >4.5kg **or**
  - Estimated fetal weight on ultrasound scan ≥97th centile when plotted on woman's personalised growth chart **or**
  - Abdominal circumference (AC) measurement ≥97th centile

NOTE: At time of **20 weeks** (second trimester screening) anomaly scan, if the AC measurement is found to be ≥97th centile currently there is **no** evidence to support the screening for gestational diabetes and therefore an **OGTT is not required**.

Patients with Previous GDM

Patients who have had GDM in a previous pregnancy and in patients with type 2 diabetes in remission or pre-diabetes the OGTT should be performed at the earliest opportunity in the pregnancy **before 16 weeks of gestation.** Alternatively, the patient can choose to commence a week of capillary blood glucose (CBG) monitoring following dating scan.

If OGTT or week of testing is normal, these patients are encouraged to have a repeat test between 24 and 28 weeks.

Patients with one or more Risk Factors for GDM at Booking should be offered OGTT as follows

- Between 24 – 28 weeks

NOTE:

- Patients on **metformin** for non-diabetes reasons (e.g., PMOS) should stop metformin for 5 – 7 days prior to OGTT.
- Patients having/had high dose of **steroids** for fetal lung maturity should postpone the OGTT by one week for a reliable result.
- Patients who are **unwell or unable to eat and drink normally** (e.g., due to vomiting) should have their OGTT delayed, as the result will not be reliable, until they have a minimum of 3 days of normal diet.

Previous Gastric Bypass surgery

Patients who have had gastric bypass surgery (excluding gastric band) should not be offered an OGTT.
Instead, it is advised to refer to the diabetes team for a week of CBG.
Testing after the dating scan, but < 16 weeks gestation.
Consider positive for GDM if raised fasting blood glucose or >3 abnormal post prandial readings.
If levels not consistent with GDM repeat between 24- 28 weeks to enable a decision on diagnosis. Ensure referral to dietetics is made at dating scan as specialised nutrition advice and monitoring is required.

Repeat OGTT in pregnancy up until 34 weeks

OGTT can be repeated if risk factors develop during the pregnancy. There should be a 4-week interval between tests and no more than two OGTTs performed during a pregnancy.

OGTT's at a later gestation i.e. after 34 weeks

Patients with features suggestive of diabetes at or after 34 weeks should **not** have an OGTT as the test is not validated at this gestation.

The following options could be considered:

- **Preferred option-** HbA1c (>39 mmol/mol) along with Fasting Blood Glucose (>5.3mmol/L).
  Or
- Referral to DSM for a period of blood glucose monitoring to enable a decision on diagnosis. Consider positive for GDM if raised fasting plasma glucose or > 3 abnormal post prandial readings.

If 2 OGTT completed at intervals are reported as normal and the risk persists, discuss with the DSM prior to conducting further screening tests.

Non Attenders

- Patients who do not attend for their OGTT should be contacted by telephone or letter to discuss rescheduling the appointment.
- Complications of undiagnosed and untreated diabetes within pregnancy should be discussed.
- Should the test be declined – documentation to be completed in the All Wales handheld notes and on hospital identification pregnancy notes.

Procedure for OGTT

The midwife booking the test will ensure the patient is made aware of the instructions for the OGTT:

- Normal diet on day preceding test.
- No food, smoking, chewing gum or antacids from 10p.m the night before the test.
- No chew gum/sweets, smoke or use E-cigarette/Vape or nicotine patches
- Plain water only may be consumed.

- Discuss regular medication , as it is likely woman will be required to stop medications prior to the test to gain a valid result.

The Midwife/Phlebotomist/ Maternity Support Worker undertaking the procedure will:

- Ensure the patient has followed the instructions prior to the test: -
  - Unrestricted diet 3 days prior to the test.
  - No medications taken prior to this test that could cause a false positive result
  - Overnight fasting from 10p.m the night before the test, only plain water consumed.
  - No chew gum/sweets, smoke or use E-cigarette/Vape or nicotine patches
- Offer information about the test and obtain verbal consent.
- Collect fasting blood glucose sample in a grey top fluoride oxalate blood bottle and label it with the patient's details including the time.
- Give the patient 75g anhydrous glucose, which is the equivalent to 113mls of Polycal liquid, diluted with water to a total volume of 200mls. This is followed 5 minutes later by a further 100mls of water.
- Inform the patient not to eat, drink or smoke until the second blood test.
- Inform the patient to rest and preferably remain in the Hospital/clinic during the test.
- Collect a second blood glucose sample in 2 hours' time and label it with the patient's details including the time.
- Patients must be advised that should the result of the OGTT indicate raised glucose levels, a diagnosis of GDM would be made. Contact will be made informing of the result by either DSM/Midwife within 48 hours of the test.

Interpretation of OGTT

Diagnose GDM if the patient has either/both:

- fasting plasma glucose of ≥ 5.6mmol/l
- 2-hour plasma glucose level of ≥7.8mmol/l

NOTE: Requires an immediate same day referral to diabetes specialist midwives if:

- Fasting plasma glucose > 10mmol/l
- Random plasma glucose > 14mmol/l
- Presence of ketones (capillary ketones >0.6mmol/l)

Management of GDM

Offer patients with a new diagnosis of GDM a review with the DSM within 1 week of obtaining the results and refer to Obstetric Led Care.

At First Visit

1. Discuss with the patient both the long and short-term implications a diagnosis of GDM has to them and their baby and that good glycaemic control throughout pregnancy will reduce the risks of-
   - Fetal Macrosomia
   - Induction of labour
   - Caesarean Birth

- Birth Trauma (Fetal and Maternal)
- Neonatal Hypoglycaemia
- Perinatal Death

2. Provide Hywel Dda UHB GDM information booklet (appendix 2).
3. Teach the patient about self-monitoring of CBG levels.
   Patients will be required to test fasting and one hour post each meal (post prandial) levels with the following CBG targets-

- Fasting Blood Glucose (FBG) <5.3mmol/L.
- Post prandial blood glucose levels at one hour <7.8mmol/L (two hour post prandial target below 6.4mmol/L).
- Patients who are on multiple daily insulin injection regimes may be required to test additional times, pre-meal in addition to post-meal and bedtime CBG levels.

4. HbA1c taken to exclude pre-existing diabetes (>48 mmol/mol)

Ongoing care

1. Review CBG levels on a 1 – 2 weekly basis, telephone or face to face.
2. Where diet/lifestyle changes fail to achieve the above glycaemic levels, initiate the appropriate oral hypoglycaemic/insulin treatment.
3. With women with diet controlled diabetes the monitoring of maternal BG and fetal growth and wellbeing aligns with that of women who require insulin and/or metformin.

Treatment

- Fasting Blood Glucose <7mmol/l at diagnosis with no other risk factors, consider trial of changes in diet and exercise.
- Fasting Blood Glucose between 6.0 and 6.9mmol/l at diagnosis with complications such as macrosomia or polyhydramnios, consider immediate treatment with insulin, with or without metformin, including changes with diet and exercises.
- • FBG ≥7.0mmol/l, consider immediate treatment with insulin, with or without metformin, including changes with diet and exercise.

Medications must be tailored to individual blood glucose profiles and with consideration of the personal preferences of the patient with GDM.

- Patients who are on multiple daily doses of insulin may be offered intermittently scanned continuous glucose monitor (isCGM / Flash) or real time continuous glucose monitor (rtCGM) if problematic hypoglycaemia occurs or they have unstable blood glucose levels that are causing concern.

Metformin

- Consider starting metformin if blood glucose targets are not being met using changes in diet and exercise within 1-2 weeks.
- Offer insulin therapy if metformin is contraindicated or declined by the patient.
- Offer insulin in addition to metformin, diet and exercise if blood glucose levels remain above target.

Hypoglycaemia safety measures using Metformin

Metformin **does not** cause hypoglycaemia.

- Patients with a CBG of <4mmol/L while being treated with metformin alone should be reassured that this is normal, and the body will itself be able to raise the BG back into normal range without specific treatment for hypoglycaemia.
- If the patient is feeling symptoms, such as dizziness, hunger, trembling or tiredness along with a CBG <4mmol/L, again they should be reassured but advised to eat a small snack. There is no requirement to repeat testing if symptoms resolve.

Insulin

Consider treatment with insulin, with or without metformin, for patients :

- who have a FBG level of ≥7mmol/l at diagnosis, or
- if blood glucose targets are not being met using changes in diet or exercise within 1 week.

Hypoglycaemia safety measures for insulin

When any patient is started on insulin ensure advice given regarding hypoglycaemia safety.

- Discuss the signs and symptoms of hypoglycaemia and advise patients to test their CBG level in these situations.
- A CBG of <4 mmol/L is considered hypoglycaemia and needs to be treated with a suitable fast acting carbohydrate). Advise patients to have these available at all times. In hospital, follow the hypoglycaemia pathway.
- A CBG should be repeated after 15 mins to ensure BG level has risen above 4mmol/L. If still <4mmol/L the treatment should be repeated until a CBG level above 4mmol/L is achieved.
- Once above 4mmol/L a slow acting carbohydrate should be consumed to maintain BG levels.

Driving

Advise patients with insulin treated diabetes to –

- Inform the DVLA if insulin is used to treat their diabetes for 12 weeks or more.
- Inform their insurance company that they have been commenced on insulin.
- Check their BG level before driving. If <5mmol/L a snack should be eaten before driving.
- Test at least every 2 hours on long journeys.
- Not to drive if BG < 4mmol/L or if they feel hypoglycaemic.

Fetal Echo Referral (Welsh Criteria, January 2021)

- GDM patients on insulin, prior to, and at the time of Anomaly scan gestation, are eligible for a referral to Fetal Medicine for a fetal echocardiogram.

Fetal Growth and Wellbeing

- Ultrasound fetal growth and amniotic fluid volume every 4 weeks from 28 to 36 weeks.
- Any women with diabetes who has risk factors for fetal growth restriction should have an individualised approach to monitor fetal growth and wellbeing

- When Small for Gestational Age (SGA) fetal growth i.e. less than 10th centile by ultrasound, where the woman is prescribed Metformin,consider alternative medication for management of diabetes.

Antenatal Admission

- During medical or obstetric admissions, diabetes/obstetric team should be informed at the earliest opportunity.
- Assess woman to exclude DKA if admitted unwell in pregnancy e.g vomiting / nausea (including hyperemesis),abdominal pain of unclear cause lethargy, tachypnoeic, tachycardia, hypotension, reduced oral intake or fasting, intercurrent infection, dehydration. Commence Diabetes in pregnancy inpatient care bundle Version 2. (See appendix 1)
- If admitted with threatened pre-term labour and steroids are prescribed, then increased CBG monitoring and review for additional insulin will be required. Diabetes and insulin or metformin are not a contraindication to steroids.

Antenatal Corticosteroids to Aid Fetal Lung Maturity

- **Offer** antenatal corticosteroids to patients presenting with suspected preterm labour before 34^{+6} weeks gestation.
- **Consider** antenatal corticosteroids if planned caesarean birth between 35 and 36^{+6} weeks gestation.
- **Do not** routinely offer antenatal corticosteroids for planned caesarean birth between 37 and 38^{+6} weeks gestation.

The decision around steroid administration for patients with diabetes needs to be individualised. The use of steroid therapy for lung maturation can substantially increase insulin requirement and place these patients at risk of developing DKA. Therefore, although diabetes should not be considered a contraindication to having antenatal corticosteroids, careful consideration needs to be given to ensure that the intended benefits will outweigh the effects of glycaemic impairment.

An informed discussion with the patient about the risks and benefits of steroid therapy needs to take place prior to administration.

Intravenous Insulin Infusion Preparation

Please see Diabetes in Pregnancy Inpatient Care Bundle Version 2 for guidance on preparing and intravenous insulin infusion.

Timings and Mode of Birth

- Obstetrician to discuss timing and mode of birth with patient during antenatal appointment around 36 week's gestation.
- Birth by 40^{+6} weeks is recommended for GDM patients treated with diet or Metformin and no other pregnancy complications.
- Consider birth between 37^{+0} and 38^{+6} for patients treated with insulin or if other risk factors are also present.
- Consider planned caesarean birth after 38^{+0} weeks for women with complicated GDM (poor glycaemic control, on insulin treatment, evidence of macrosomia and other risk factors for fetal growth restriction).

- All patients with GDM treated with insulin are advised to birth in the Obstetric Unit at Glangwili Hospital.
- All patients treated with diet and / or metformin can choose to birth in Glangwili Hospital or Bronglais Hospital.
- The national guidelines do not recommend home birth/MLU for labour/birth for patients with GDM. A referral to birth choice clinic is required if a patient requests this option.
- Offer monitoring of fetal wellbeing (using methods such as fetal Umbilical Artery Doppler, fetal CTG), if pregnancy is continued beyond 38 weeks in patients with complicated GDM or beyond 41 weeks in women with uncomplicated GDM.

Colostrum Harvesting and Breastfeeding

Colostrum harvesting and breastfeeding should be discussed and encouraged in all women with GDM from 36 weeks gestation.

Breastfeeding has long and short-term benefits for both mother and baby.

Mother

- Reduced chance of breast cancer and ovarian cancer.
- Reduced risk of developing type 2 diabetes.

Baby

- Improved mother and baby bonding.
- Improves normoglycaemia more effectively than formula milk.
- Protection against infection and necrotising enterocolitis.
- Improved intelligence and lifestyle achievements.
- A reduction in the rate of obesity in childhood and adolescence.
- A reduction in type 2 diabetes in childhood, adolescence and adulthood.
- A reduction in the risk of type 1 diabetes.

Induction of Labour

Patients with GDM should be booked for IOL as a high priority case, reducing the chance of being delayed.

On admission, follow routine IOL protocol.

During IOL

- FBG and 1 hour post prandial CBG levels need to be monitored using hospital Glucometer. Targets:
  - Fasting Blood Glucose <5.3mmol/l
  - 1 hour post prandial <7.8mmol/l.
- All diabetes medications to continue. Patients should be encouraged to continue to self-administer their medications.
- Patients can eat and drink as normal. Advised patients that they can order a low carb ‘diabetes breakfast’ when placing food order.

Intrapartum Care

- Commence Diabetes in Pregnancy Inpatient Care Bundle.
- Patients can eat and drink as normal during labour.
- **Stop Bolus insulin** (mealtime) **and Metformin** once in established labour or when active management has begun.
- **Continue Basal insulin** (long acting) throughout labour.
- Monitor CBG levels hourly on hospital Glucometer and document on the CBG monitoring chart. The target CBG range during labour is 5 - 8 mmol/l.
  If CBG ≥11.0mmol check blood ketones (BK).
  If BK >0.6mmol/L follow DKA guidance in the care bundle.
- If GA is required for birth, CBG must be tested at 30-minute intervals until patient has regained full consciousness.

Planned Caesarean Birth (AM Surgery)

Once booked for planned caesarean birth the DSM will advise the patient about medication administration prior to surgery.

- **Metformin**- should be taken as usual the day before surgery.
- **Bolus Insulin**- should be taken as usual with meals the day before surgery.
- **Basal Insulin-** should be taken as usual the night before surgery.

Patients are advised to be NIL BY MOUTH from 10pm the night before surgery. Once NMB, no further diabetes medications should be administered.

On Admission

- Commence Diabetes in Pregnancy in-patient care bundle (appendix 3).
- Check CBG within an hour of admission. Target parameters 5 - 8mmol/L.
- CBG <5mmol/L but >4mmol/L, recheck CBG in one hour.
- CBG <4.0mmol/l, treat as per hypoglycaemic pathway (in care bundle).
- CBG >8.0mmol/L on 2 consecutive occasions with a 30-minute interval, treat with variable rate intravenous insulin infusion (VRIII) as per Diabetes in pregnancy in-patient care bundle.
- If GA is required for birth, CBG must be tested at 30-minute intervals until patient has regained full consciousness.

Neonatal Care

To help avoid neonatal hypoglycaemia, aim for maternal CBG to be maintained between 5 - 8mmol/L during labour and birth.

- Babies of patients with diabetes should be cared for on the obstetric postnatal ward.
- Diabetes in pregnancy carries the risk of hypoglycaemia, respiratory distress syndrome, polycythaemia, jaundice and hypothermia in the neonate.
- Babies should be fed within an hour of birth and the hypoglycaemia pathway guidance commenced.
- Advise patients that breast milk restores normoglycaemia more effectively than formula milk.
- Observation of the clinical and neurological status should be documented.

Postnatal Care

On birth of the placenta follow guidance in the Diabetes in Pregnancy in-patient care bundle (appendix 3).

Information and Follow Up After Birth

- Health care professionals should inform women with GDM of their increased risk of GDM in future pregnancies and of developing type 2 diabetes in the future with explanation that this risk can be reduced by lifestyle changes i.e., diet, exercise and weight control. Discuss contraception and the risks of uncontrolled diabetes to pregnancy.
- Advise woman that she will be able to self-refer to DSM in further pregnancies
- Following diagnosis of gestational diabetes the diabetes specialist midwives (DSM) will provide women with the Baby steps App – *Walking yourself away from type 2 DM.*
- Postnatally the DSM will refer woman to the primary Health Care Team for a HbA1c 13 weeks post birth to determine whether glucose tolerance has normalised Further care is dependent on results
    - HbA1c<39mmol/mol or 5.7% - moderate risk of future type 2 diabetes – recommended to follow lifestyle advice and have an annual test for diabetes.
    - HbA1c 39 – 47 mmol/mol or 5.7 – 6.4% - high risk of future diabetes, recommended to follow lifestyle advice and have an annual test for diabetes.
    - HbA1c 48 mmol/mol, 6.5% or above - likely to have diabetes and needs a diagnostic test for confirmation.
- All patients should be offered an annual HbA1c in primary care.
- Women who fit the criteria for referral will be referred to the Diabetes prevention team by the DSM and will receive an invitation letter 4 months post birth

Auditable Standards

- Appropriate referral for screening for Gestational Diabetes for women identified to be at an increased risk
- Appropriate use of antenatal corticosteroids
- Appropriate adherence to Diabetes I Pregnancy Bundle
-

References

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Appendix 1. Psychotropic medication requiring screening for gestational diabetes

Psychotropic medication with a theoretical risk of developing Gestational Diabetes Mellitus (GDM)

Please screen women taking following medication with OGTT		
Antipsychotics with association to cause impaired glucose tolerance	Lower risk of association with impaired glucose intolerance	Associated risk of increased appetite and screening is advised
• Clozapine	• Aripiprazole	• Amitriptyline
• Olanzapine	• Amisulpride	• Nortriptyline
• Quetiapine	• Cariprazine	• Mirtazapine
• Risperidone	• Lurasidone	
• Haloperidol		

Appendix 2. Patient invitation to attend for Oral GTT

Bwrdd Iechyd Prifysgol Hywel Dda University Health Board

Invitation to attend an Oral Glucose Tolerance test (OGTT)

Oral Glucose Tolerence Test (OGTT)

Date.....Time.....
Location.....
Phone no . .....

Name:

Hospital No:

What is an Oral Glucose Tolerance test ?

A GTT is carried out during pregnancy to find out if you have developed Gestational Diabetes Mellitus (GDM). This is usually a temporary form of diabetes characterised by high blood glucose levels that typically disappears following birth. The test is most often carried out between 24 – 28 weeks of pregnancy. It may be done earlier in pregnancy, but this will depend on your individual circumstances.

Why am I having this test?
You will be offered this test if you have any of the following: -

- Confirmed gestational pregnancy in a previous pregnancy
- Body Mass Index (BMI) is over 30.
- Polyendocrine metabolic ovarian syndrome (PMOS)
- Take certain medication i.e. Antipsychotic medication.
- Previous bariatric surgery
- Previous large baby weighing over 4.5kg (9 pounds and 14 ounces)
- Maternal age of 40 and above at booking.
- Family history of diabetes (1st degree relative, i.e. parents or siblings).
- Ethnic family origin e.g. South Asian (specifically India, Pakistan or Bangladesh) Middle Eastern (specifically Saudi Arabia, United Arab Emirates, Iraq, Jordan, Syria, Oman, Qatar, Kuwait, Lebanon or Egypt), Black African or African Caribbean.

Are there any other reasons I may need to have screening for GDM ?
Other reasons include:

- Sugar in your urine (glycosuria)
- Increased fluid surrounding the baby (polyhydramnios)
- Large baby with a large abdominal circumference/ estimated weight detected by scan.

What does the test involve?

- Do not eat or drink anything other than plain water after 10pm the night before your test.
- Do not chew gum/sweets, smoke or use E-cigarette/Vape or nicotine patches as this may affect your results
- Discuss regular medications in advance with your Health Professional prior to the test.
  a. Patients on metformin for non-diabetes reasons (e.g. polycystic ovarian syndrome) should stop metformin 5 – 7 days prior to OGTT.
  b. Patients having/had high dose of steroids for fetal lung maturity should postpone the OGTT by one week for a reliable result.
  c. Patients who are unwell or unable to eat and drink normally (e.g., due to vomiting) should have their OGTT delayed, as the result will not be reliable, until they have a minimum of 3 days of normal diet.
  d. Patients who have had a gastric bypass surgery (excluding gastric band) should not be offered an OGTT.
- On arrival to the department a fasting blood sample will be taken.
- You will be asked to drink a glucose drink.
- You will then need to wait in the department for 2 hours without eating or drinking (except plain water).
- After 2 hours the final blood sample is taken.
- Once the test is complete; you may eat and drink as normal.

If your result is abnormal, you will be given an appointment with the Diabetes Specialist Midwife or Diabetes Specialist Nurse within a week of the result. You will be invited to attend a joint diabetes clinic where you will be taught how to monitor your blood glucose levels by finger prick test. You will be seen by a dietician for individual guidance about your diet and the growth of your baby will be closely monitored by ultrasound measurement.
The aim of good diabetes control in pregnancy is to reduce the chance of complications for both you and your baby.
Contact Diabetes Midwives DiabeticSpecialistMidwives.hdd@wales.nhs.uk

Appendix 3. Gestational Diabetes Patient information

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Hywel Dda University Health Board

Gestational Diabetes Mellitus (GDM)

Information for pregnancy, birth & after your baby is born

Mae'r daflen hon ar gael yn Gymraeg. Gofynnwch i'ch bydwraig.

You have been diagnosed with Gestational Diabetes Mellitus (GDM).

We have put together this pack to provide you with:

- Information about your diagnosis
- A glucose meter for you to check your blood glucose levels four times a day
- Information on how to use the meter to obtain a sample
- Information on how to set up the **Glooko App** so that we can review your blood glucose readings remotely (this information is provided on a separate information sheet within your pack)
- Please **do not** download any other apps for the blood glucose meter as your health care team are only able to review your readings via the Glooko app
- Diet and lifestyle information to help you manage your diabetes during pregnancy
- Information about managing your diabetes during labour, birth and the immediate postnatal period
- Information on colostrum harvesting and breastfeeding following a diagnosis of gestational diabetes
- Recommendations for follow up care in the postnatal period

We have sent a letter to your GP informing them of your diagnosis. We have asked them to provide repeat supplies of testing strips and lancets and will request they provide future health surveillance for you following the birth of your baby.

Please ensure that you let your GP/Pharmacy know that you need a repeat prescription a few days before you run out of supplies to allow them enough time to dispense them.

We will telephone you to answer any questions and to arrange future follow up. Please continue with all other routine appointments.

Contact Details

For patients receiving care in Glangwili or Withybush General Hospitals-
Emma Banks 07970 948705 / Daisy Hodson 07816 180028
Please save these numbers into your phone.
Email- DiabeticSpecialistMidwives.hdd@wales.nhs.uk
For patients receiving care in Bronglais General Hospital-
Email- diabeticnursesceredigion@wales.nhs.uk
Dietitians- DiabetesDietitians.HDD@wales.nhs.uk

We will be available to contact on the phone Monday- Friday 9-4, annual leave dependent. For any queries outside this time please send an email to the above address and we will get in contact the next working day.

For any urgent queries outside of working hours please contact Antenatal Triage GGH on- 01267 248682.

What is Gestational Diabetes Mellitus (GDM)

Gestational diabetes is high blood glucose (sugar) that develops during pregnancy and usually disappears after giving birth.

It can happen at any stage of pregnancy, but is more common in the second or third trimester.
It happens when your body cannot produce enough insulin – a hormone that helps control blood glucose levels – to meet your extra needs in pregnancy.

Gestational diabetes can cause problems for you and your baby during pregnancy and after birth. But the risks can be reduced if the condition is detected early and well managed.

How is GDM treated?

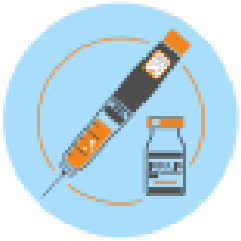
The most important treatment is a healthy balanced diet, including some light exercise. Making healthy changes to your diet is sometimes all that is required to maintain normal blood glucose levels.

If your blood glucose levels are above target, it is useful to make a record of what you have eaten so that changes to your diet and food swaps can be made if needed.

Medications used to treat gestational diabetes

Should the target blood glucose levels not be achieved, medications such as metformin and insulin, may be required. You will be offered metformin as a first treatment option.

Metformin is a tablet that helps lower your blood glucose levels by reducing the production of extra glucose by the liver and reducing the amount of glucose absorbed by the intestines. Metformin is started at a low dose to minimise any side effects and once tolerated, the dose can be increased.



Insulin is a hormone that allows glucose to enter the cells to produce energy. Insulin is administered by a small injection. You will receive education and support to administer the insulin safely if this is needed.

Any medications started in pregnancy will stop once your baby is born.

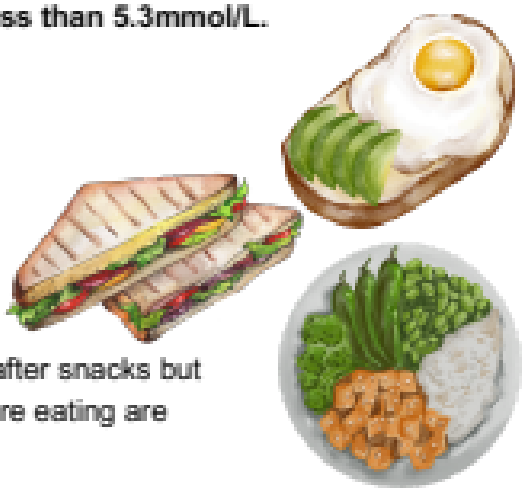
Will I always have diabetes?

GDM usually goes away after your baby is born. But you are at a higher risk of developing type 2 diabetes later in life. Advice and support will be provided by your health care team in the postnatal period to help reduce the risk of this happening.

How to monitor my Gestational Diabetes

In order for your health care team to monitor your diabetes and make sure that it is treated appropriately, you will need to test your blood glucose levels, with a finger prick tester, **four times a day.**
Please refer to the **'Quick Start' guide** within the meter box which will let you how to take a blood glucose reading.

You will need to take a blood glucose reading first thing in the morning after waking, before you have had anything to eat or drink. This is called your **fasting blood glucose.** This reading needs to be **less than 5.3mmol/L.**



You will also need to take a blood glucose reading one hour after finishing each of your main meals. This is called your **Post Meal Glucose.** This reading needs to be **less than 7.8mmol/L.**

You do not need to test your blood glucose after snacks but you should make sure that the snacks you are eating are healthy.

If you don't usually eat three meals a day, please mention this to a member of your diabetes team and they will give you advice about how to manage this.

Please follow the separate information sheet about how to link your phone and meter to the **Glooko App.**

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Additional Resources

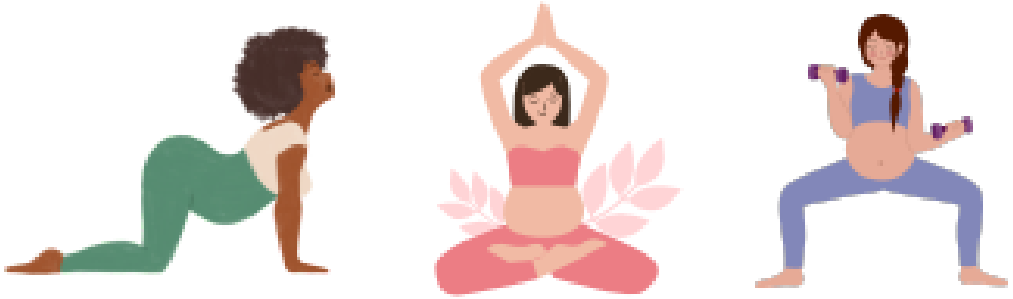
DIABETES UK
KNOW DIABETES. FIGHT DIABETES.

Royal College of Obstetricians & Gynaecologists

Please access the RCOG webpage on Gestational Diabetes and the Diabetes UK Gestational Diabetes webpage for more information and advice about your diagnosis and how it will impact the remainder of your pregnancy. If you have any questions, please discuss them with a member of your Diabetes Specialist Team.

Exercise during Pregnancy

Being active during pregnancy is important. Regular, light exercise following a diagnosis of Gestational Diabetes can help with the management of your blood glucose levels.
Please scan the QR code to access a website that provides advice about safe exercise during pregnancy.



6

An Invitation for People Living with Diabetes

POCKET MEDIC®

We invite you to watch a short series of films as part of your treatment plan.

Each film has been created by NHS healthcare professionals and people living with diabetes to help you to further understand and manage your condition.
To watch these films please scan the QR code:

https://pocketmedic.org/pregnancy-and-diabetes/

https://pocketmedic.org/prediabetes

The films have been made as part of a national plan to support the many people in Wales living with a long-term condition.

When you have watched all the films in the series please let us know by completing 4 very short questions on the survey link from the landing page.

If you have any difficulties accessing the films or have any comments, please email the team at patient@pocketmedic.org

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Plan of Care

How will having GDM affect my antenatal care?

You will continue with the regular appointments with your community midwife.

First appointment	Test results discussed - Information and support provided, advice to start blood glucose testing, timings and targets discussed Recommended to download an App to link to your blood glucose meter for remote 1-2 weekly reviews until your baby is born. Referral to a dietitian for a dietary consultation.
28 weeks	Review blood glucose levels, provide information and advice on any changes recommended. Scan to check the well-being of your baby, including growth and volume of fluid around your baby. Routine 28 week bloods/ offered a HbA1c blood test.
32 weeks	Review blood glucose levels. Scan to check the well-being of your baby, checking the growth and volume of fluid around your baby. Discussion on place of birth.
36 weeks	Review blood glucose levels. Scan to check the well-being of your baby, including growth and volume of fluid around your baby. Discussion on feeding your baby with education on colostrum harvesting. Discussion on blood glucose monitoring during labour, birth, and the postnatal period. Obstetrician will discuss timings and mode of birth, dependant on treatment for GDM and wellbeing of your baby and individual circumstances.
38 weeks	Review of blood glucose levels. Opportunity for discussion and revisit any questions you may have with regards to feeding, birth, postnatal and follow up in primary care.

Feeding Your Baby & Colostrum Harvesting

From 36 weeks of pregnancy, we encourage expressing colostrum (first milk) and storing it for use after birth. This can be helpful if breastfeeding is difficult initially and for those whose babies are at higher risk of low blood glucose levels in the hours after birth.

Preparing for feeding your baby - Before the birth

Colostrum is a mothers important first milk for her baby. It has important immunity and protective factors and is the perfect food for a new baby. Some babies have a tricky start to feeding: having a small store of mum's colostrum ready can help baby in the first 24 hours after birth

You can begin antenatal expressing colostrum at 3[illegible] completed weeks. This can be practically useful for women with diabetes, multiple birth or if early birth/ Caesarean is expected or planned.

You can hand express 3 times a day for 3-5 minutes. It's completely normal to have nothing the first couple of times - it just takes practice. Some women don't see much or any colostrum at all but Hand expressing is a useful skill to learn, helps you relax and get comfortable.

Helping your milk to flow.
Gentle breast massage, apply a hot compress or express after shower or bath

Storing and labelling your milk.
Name, your date of birth and the date the milk was expressed. When taken out of the freezer, store in the fridge and use within 24 hours

Collecting your milk.
Your midwife will help you get started with a colostrum harvesting pack and this will include little syringes. Collect the drops in to the syringe each time you express in 24 hours - keep the syringe in the fridge in between and then store in the freezer

Very occasionally expressing may stimulate mild contractions. If these occur each time you express, stop and discuss with your midwife for further guidance.

Going to have your baby.
Bring your frozen colostrum in a cool bag with a ice pack inside. Ask the midwife to store this in the ward milk fridge or freezer depending when your baby is expected to be born.

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Breastfeeding is safe if you have gestational diabetes. It is a great way to bond with, and get to know your baby. Your healthcare team will support you with this.

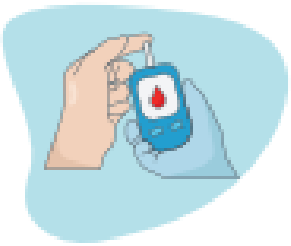
Exclusively breast feeding your baby for the first 6 months can reduce your chance of developing diabetes after pregnancy by up to 50%.
Breastfeeding will also lower your baby's risk of developing asthma, obesity, diabetes and sudden infant death syndrome (SIDs)

However you decide to feed your baby, you should start feeding as soon as possible after birth and every 2-3 hours to help your baby's blood glucose levels stay stable

For more information on infant feeding, please scan the QR code below for the Hywel Dda Maternity Services website

For information on labour and birth, including induction of labour and pain relief options, please visit the Hywel Dda Maternity Services website.

Managing Blood Glucose during Labour & Birth



Spontaneous Labour or Induction of Labour (IOL)

- Blood glucose monitoring, metformin and/or insulin should continue as usual during Induction of Labour and the first stage of labour, until you are in active labour.
- Once in active labour or active management of labour, your midwife will check your blood glucose every hour. Target blood glucose is 5-8mmol/l.
- If your blood glucose goes above 8mmol/l for two consecutive readings, you may require an intravenous (IV) insulin infusion to keep levels stable.
- If blood glucose drops below 4mmol/l, you will be given treatment to raise it.
- While admitted for IOL, a high protein, cooked breakfast can be ordered to assist in keeping your blood glucose levels stable
- For further information on IOL, please read the Induction of Labour Booklet, or visit the Induction of Labour page on the Hywel Dda Maternity website.

Planned Caesarean Birth

- Planned caesareans are usually scheduled in the morning
- Blood glucose monitoring, metformin and/or insulin should continue as usual, up until the night before surgery. These will be your final doses of medication to manage your Gestational Diabetes
- Your blood glucose will be checked before and after birth

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Why is blood glucose control Important?

Keeping your blood glucose within target levels before and during birth helps your baby's blood glucose stay stable after birth.
During pregnancy, your baby produces their own insulin. If your blood glucose has been high, your baby may have produced extra insulin, which could cause them to have low blood glucose (neonatal hypoglycaemia) after birth.
To check for this, the healthcare team will test your baby's blood glucose using a heel-prick test. Unless there are other health concerns, your baby will be kept with you on the ward, and may have at least 24 hours of testing.

After your baby is born

Your baby will usually stay with you unless they need extra support.
Skin-to-skin contact is encouraged and will be supported by your midwife. Keeping your baby warm helps to keep their blood glucose stable.
Feeding your baby as soon as possible (within the first hour) and at least every 2-3 hours will also help keep baby's blood glucose stable.
Gestational Diabetes usually goes away after birth, so you should stop taking your diabetes medication immediately after birth.
Your blood glucose, along with baby's, will be monitored on the ward afterwards to ensure levels have returned to normal.

Reducing Your Risk of Type 2 Diabetes

Having Gestational Diabetes increases your risk of developing Type 2 Diabetes by 50% within 5 years of birth.

To reduce your risk:

- It is important that you have a blood test to check your HbA1c (average blood glucose level), approximately 13 weeks after birth. Please ensure you have this done with your GP
- Following this, we recommend a yearly blood test to check your HbA1c, this will indicate average blood glucose levels over the 12 weeks before. It is important that you have this test, even if you feel well, as Type 2 Diabetes in the early stages may not cause any noticeable symptoms
- Eat a healthy, balanced diet and stay physically active

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Support Available

You will be offered access to the Babysteps Digital Diabetes Prevention Programme. Please use the QR code to register

Let's Prevent Diabetes! | BABY STEPS

If you have been identified as eligible, you will also be referred to the Diabetes Prevention Programme. The team will contact you 4-6 months after birth to offer support and guidance on ways to reduce your risk of developing type 2 diabetes in the future. Should you wish to discuss your eligibility or referral, please email DMprevention.HDD@wales.nhs.uk

Planning For Future Pregnancies

If you become pregnant again, you are at higher risk of developing gestational diabetes.

Maintaining a healthy weight, eating a balanced diet and keeping active before you become pregnant can reduce the risk of Gestational Diabetes. To help reduce your risk of developing Gestational Diabetes in your new pregnancy, we would recommend following the dietary advice that was beneficial to you during your previous diagnosis of Gestational Diabetes.

When you find out you pregnant, let your health care team know and make sure they are aware that you have had Gestational Diabetes in a previous pregnancy. You will be offered an appointment for an oral glucose tolerance test (OGTT) at approximately 16 weeks of pregnancy. If the result is normal, the test will be repeated at approximately 26 weeks of pregnancy.

Disposing of Testing Equipment & Medication

- Blood glucose meters cannot be reused. It can be disposed of in general household waste (remove battery first and dispose of this appropriately)
- Unused needles should be placed in sharps bin and returned to your GP surgery or pharmacy for safe disposal
- Unused medication should be returned to a pharmacy

Appendix 4.Diabetes in Pregnancy Inpatient Care Bundle V2

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol
Hywel Dda
University Health Board

THINKGLUCOSE
Inpatient care for people with diabetes

Diabetes in Pregnancy Inpatient Care Bundle

Version 2: 2026

Addressograph

Please check all details are correct on addressograph before applying

Improving patient care

This Document includes:

- **Glycaemic control during steroid administration for promotion of fetal lung maturity**
- **Glycaemic control during Labour and Birth**
- **Diabetes in pregnancy – presents unwell**

JBDS-IP Joint British Diabetes Societies for inpatient care

NICE National Institute for Health and Care Excellence

Royal College of Obstetricians & Gynaecologists

Scope of the care bundle

The care bundle provides guidance on the management of women with pre-existing Diabetes (Type 1 DM or Type 2 DM), or Gestational Diabetes Mellitus (GDM) when admitted to the maternity unit in the following situations:

- Steroid administration for lung maturation
- Labour and Birth
- Unwell in pregnancy - exclude diabetic ketoacidosis (DKA) in pregnancy.

The emphasis throughout this care bundle is on safe use of insulin to achieve best possible outcome for both mother and baby.

This care bundle has been adapted from the Joint British Diabetes Societies (JBDS), 2023 Managing diabetes and hyperglycaemia during labour and birth https://abcd.care/sites/abcd.care/files/site_uploads/JBDS_Guidelines_Current/JBDS_12_Managing_diabetes_and_hyperglycaemia_during_labour_and_birth_with_diabetes_February_2023.pdf

And Hywel Dda UHB Adult VRIII Care Bundle Version 1 2023

Documentation record of staff signatures

The first time any staff document in this record, they should put their job title, name, signature and initials here.

Job Title	Name (print)	Signature	Initials

Contact email/ number for referrals -

DiabeticGGH.HDD@wales.nhs.uk 0300 303 8322 select option 5

DiabeticSpecialistMidwives.hdd@wales.nhs.uk

diabeticnursesceredigion@wales.nhs.uk 01970 635750

Abbreviations & Glossary

Alg	Algorithm
ARM	Artificial Rupture of Membranes
CBG	Capillary Blood Glucose
CGM	Continuous Glucose Monitoring
CRP	C-Reactive Protein
CTG	Cardiotocography
DKA	Diabetic Ketoacidosis
DM	Diabetes Mellitus
DSM	Diabetes Specialist Midwife
DSN	Diabetes Specialist Nurse
FBC	Full Blood Count
GDM	Gestational Diabetes Mellitus
IV	Intravenous
KCl	Potassium Chloride
MW	Midwife
NaCl	Sodium Chloride
POCT	Point of Care Testing
U & E	Urea & Electrolyte
VRIII	Variable Rate Intravenous Insulin Infusion

Glucose monitoring - All women with diabetes are provided with equipment to check and monitor capillary blood glucose (CBG) levels. Some women may use continuous glucose monitoring (CGM) which gives the option to receive high and low glucose alarms. CGM measures interstitial glucose levels and changes may lag 5 – 10 minutes behind capillary blood glucose measurements. CGM can be used by women to guide their diabetes self-management but **SHOULD NOT BE USED** to guide VRIII doses.

For all women with diabetes additional capillary blood glucose monitoring should be performed during steroid administration, labour and birth and illness.

Intermediate/Basal Insulin - A longer acting insulin given once or twice daily e.g. Levemir (Detemir), Lantus (Glargine), Toujeo (Glargine), Abasaglar (Glargine), Tresiba (Degludec) and Humulin I (Isophane).

Bolus Insulin –A shorter acting insulin given before meals and/or to correct elevated blood glucose levels e.g. Fiasp (insulin aspart), NovoRapid (insulin aspart), Humalog (insulin lispro) and Lyumjev (insulin lispro).

Algorithm for the Management of Hypoglycaemia in Adults with Diabetes in Hospital
Hypoglycaemia is a serious condition and should be treated as an emergency regardless of level of consciousness
Hypoglycaemia is defined as blood glucose of <4.0mmol/L (if not <4.0mmol/L but symptomatic give a small carbohydrate snack for symptom relief)
See full guideline "The Hospital Management of Hypoglycaemia in Adults with Diabetes Mellitus" at www.diabetes.org.uk/joint-british-diabetes-society
Mild
Moderate
Severe
Adults who are conscious, orientated and able to swallow
Check ABCDE, stop IV insulin (if running)
Give 15-20g of quick acting carbohydrate, such as 5-7 Glucose tablets or 4-5 Lift GlucoTabs® or Glucojuice Lift 60mls or 150-200ml pure fruit juice**
Test blood glucose level after 10-15 minutes and if still less than 4.0mmol/L repeat treatment as above up to 3 times. If still hypoglycaemic, call doctor and consider IV glucose or IM glucagon as per "severe" pathway
Patient conscious and able to swallow, but confused, disorientated or aggressive
Check ABCDE, stop IV insulin (if running)
If capable and cooperative, treat as for mild hypoglycaemia. If not capable and cooperative but can swallow give 2 tubes of 40% glucose gel (squeezed into mouth between teeth and gums).
Test blood glucose level after 10-15 minutes and if still less than 4.0mmol/L repeat as above up to 3 times. If still hypoglycaemic, call doctor and consider IV glucose or IM glucagon as per "severe" pathway
Patient unconscious/fitting or very aggressive or nil by mouth (NBM)
Check ABCDE, stop IV insulin, request medical support urgently Medical emergency call 2222
Give 100ml 20% Glucose 400ml/hour or 200ml 10% Glucose 800ml/hour over 15 minutes
If IV access not possible use 1mg Glucagon IM*
Recheck glucose after 10 minutes and if still less than 4.0mmol/L, repeat treatment as abo
Check glucose after 10-15 minutes. Once blood glucose level are now > 4.0mmol/L or above: Give 20g of long-acting carbohydrate e.g. two biscuits, slice of bread, 200-300ml milk or next carbohydrate containing meal. Give 40g if IM glucagon has been used. For patients with enteral feeding tube give 20g quick acting carbohydrate via enteral tube e.g. 50-70ml Ensure® Plus juice or Fortijuce®.
If glucose now 4.0mmol/L or above, follow up treatment as described on the left.
If NBM, once glucose >4.0mmol/L give 10% glucose infusion at 100ml/hr until no longer NBM or reviewed by doctor
DO NOT omit subsequent insulin doses. Continue regular capillary blood glucose monitoring for 24-48 hours. Review insulin and/or oral hypoglycaemic doses. If previously on IV insulin, would generally consider restarting insulin once blood glucose >4.0 but may require review of regimen. Give hypoglycaemia education and refer to inpatient diabetes team if required.
*Glucagon may take up to 15 minutes to work and may be ineffective in treating hypoglycaemia in undernourished patients, in severe liver disease, sulfonylurea induced hypoglycaemia and in repeated hypoglycaemia.

Glycaemic control during corticosteroid administration

Corticosteroid administration in women who have diabetes will usually be associated with deterioration in maternal glucose levels for 2-3 days and can precipitate diabetic ketoacidosis (DKA).

All women with diabetes receiving corticosteroids should be admitted to the ward.

Inform Diabetes Specialist Nurse (DSN) / Diabetes Specialist Midwife (DSM) of admission.

Insert a cannula and check urea and electrolytes.

Commence 1 – 2 hourly capillary blood glucose monitoring with hospital glucometer following the first dose of corticosteroid and continue for a minimum of 24 hours following second corticosteroid dose.

Target capillary blood glucose during corticosteroid administration is 5.0 – 8.0 mmol/L.

Metformin (if taken) can be continued alongside usual diet.

Continue usual dose long acting basal / intermediate subcutaneous insulin.

Continue usual dose fast acting bolus subcutaneous insulin if patient is eating and drinking.

If capillary blood glucose > 8.0 mmol/L on 2 consecutive occasions commence variable rate intravenous insulin infusion (VRIII) (50 units **Actrapid** insulin in 49.5 ml of 0.9% sodium chloride) with hourly blood glucose.

Use substrate fluids alongside VRIII even if eating and drinking. Use 5% glucose in 0.9% sodium chloride plus 0.15% (20 mmol/L) potassium chloride. Infuse at a rate of 50ml/hour to avoid hypoglycaemia, hyponatraemia and hypokalaemia.

Continue VRIII for minimum of 24 hours following second dose of corticosteroids. VRIII may need to continue longer if target capillary blood glucose < 8.0 mmol/L is not achieved.

Repeat urea and electrolytes daily. Refer to hyponatraemia guidance for sodium parameters.

Check capillary blood ketones if blood glucose > 11.0 mmol/L.

Additional fluid may be needed in some patients if not eating / drinking adequately.

Some fluids, particularly glucose may need restriction in the event of hyponatraemia.

Insulin without substrate fluids may rarely have to be used.

Particular care relating to fluid management is needed in those with pre-eclampsia – seek senior obstetric advice.

Insulin Pump therapy during steroid administration

Inform the diabetes specialist team as soon as possible about the plan to use steroid therapy. The insulin pump can usually continue but the diabetes team will need to inform patient about appropriate changes to basal rate and bolus doses.

Glucose levels should be monitored by the patient every 1-2 hours. This may be done using a continuous glucose monitor. In addition, capillary blood glucose will need to be checked on hospital glucometer at least pre meals and pre bed as a minimum.

Target blood glucose during corticosteroid administration is 5.0 – 8.0 mmol/L.

A temporary increase in the basal rate is likely to be needed following corticosteroid administration and typical changes are noted below.

- 6-24 hours Increase basal rate to 125%
- Day 2-3 Increase basal rate to 140% and increase usual bolus by 40%
- Day 4 Increase basal rate to 120% and increase usual bolus by 20%
- Day 5 Increase basal rate to 110% and increase usual bolus by 10%
- Day 6 – 7 Infusion rate should return to normal

If blood glucose levels are above target the patient can use a corrective dose of insulin aiming for target values 5.0 – 8.0 mmol/L. If corrective dose fails to achieve blood glucose target after 1 – 2 hours then convert to VRIII. The insulin pump can remain in place (**in manual mode**) and continue the programmed basal rate. The woman should continue to administer her bolus insulin at mealtimes.

Check capillary blood ketones if blood glucose > 11.0 mmol/L.

Intravenous Insulin Prescription and Fluid Protocol

FOR MANAGEMENT OF STEROID HYPERGLYCAEMIA DURING PREGNANCY

For use for ALL patients receiving Variable Rate Intravenous Insulin Infusion (VRIII) for the management of steroid hyperglycaemia during pregnancy
NEVER use an IV syringe to draw up insulin
ALWAYS draw up insulin using an insulin syringe
ALWAYS continue subcutaneous intermediate, basal and bolus insulin
Doctor: All prescriptions for insulin and fluids must be signed
Midwife: All entries must be signed

Ward	Consultant	Admission Date:
		Discharge Date:
Surname		First Name
Hospital Number		Date of Birth / Age
NHS Number		
Address		

	DOSING ALGORITHM (Please see the guide below)			
	Algorithm 1	**Algorithm 2**	**Algorithm 3**	**Algorithm 4**
CBG Levels (mmol/L)	For most women	For women not controlled on algorithm 1 or needing >80 units/day of insulin	For women not controlled on algorithm 2 (after specialist advice)	Customised scale
	Infusion Rate (units/hr = ml/hr)			
<5	STOP INSULIN FOR 20 MINUTES If CBG < 4 treat hypo as per guideline (re-check CBG in 10 minutes)			
5.0 – 5.5	0.5	0.5	1.0	
5.6 – 7.0	0.5	1.0	2.0	
7.1 – 8.5	1.0	1.5	3.0	
8.6 – 11.0	1.5	2.0	4.0	
11.1 – 14.0	2.0	2.5	5.0	
14.1 – 17.0	2.5	3.0	6.0	
17.1 – 20.0	3.0	4.0	7.0	
>20.1	4.0	6.0	8.0	
Signed				
Print Name				
Date				

ALGORITHM GUIDE

- **ALL** women with diabetes should have capillary blood glucose (CBG) checked hourly whilst on VRIII for the management of steroid hyperglycaemia during pregnancy.
- Start VRIII and Fluids if two consecutive CBG > 8.0 mmol/L and continue for at least 24 hours after the last dose of steroid.

Algorithm 1 Most women will start here.

Algorithm 2 Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; those not achieving target on algorithm 1).

Algorithm 3 Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review).

Algorithm 4 If higher or lower customised scale is required.

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target CBG level = 5.0 – 8.0 mmol/L
Check CBG every hour whilst on VRIII
Move to the higher algorithm if the CBG is > target and is not dropping
Move to the lower algorithm if CBG falls below 5.0 mmol/L or is dropping too fast, advise to take 10g carbohydrates.

Drug	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date	SYRINGE PREPARATION			
							Prepared by 2 MW	**Date**	**Time started**	**Time stopped**
Actrapid	50 UNITS	Made up to 50ml with Sodium Chloride 0.9% (1 UNIT per ml)	IV							

INTRAVENOUS SUBSTRATE FLUID PRESCRIPTION

Date	Intravenous Fluid and Rate	Alternative Rate	Prescriber's Signature	MW Signature X 2
	500ml Sodium Chloride 0.9%, Glucose 5% with 20 mmol/L Potassium Chloride (0.15%) to run at 50 ml/hr.		1	
			2	
			3	

PRESCRIPTION OF INTRAVENOUS DEXTROSE FOR MANAGEMENT OF HYPOGLYCAEMIA

Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		Glucose 10%	**150 ml**	**IV**	**10 min**				

Maintain IV insulin infusion for 30 minutes after re-starting original insulin regime – IV insulin has a 5 minute half-life

Monitoring Record Sheet during management of steroid glycaemia
Diet treated/Oral treated/Sub cutaneous Insulin/Insulin Pump

Guide:

Only use for patients with diabetes treated with diet and/or metformin and/or subcutaneous insulin and/or insulin pump not requiring VRIII.

Target capillary blood glucose (CBG) 5.0 – 8.0 mmol/L.

Make sure the patient's hands are clean.

Check capillary blood glucose 1– 2 hourly and for a further 24 hours after the second steroid administration.

Check capillary blood ketone (CBK) if CBG > 11.0mmol/L or patient is unwell.

Start VRIII if 2 consecutive capillary blood glucose > 8.0 mmol/L.

If VRIII is commenced start capillary blood glucose (CBG) monitoring hourly and document on monitoring sheet for VRIII.

Addressograph Label

Date: / /	00.00	01.00	02.00	03.00	04.00	05.00	06.00	07.00	08.00	9.00	10.00	11.00
CBG												
CBK												
Initials												
Date: / /	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00
CBG												
CBK												
Initials												

Date: / /	00.00	01.00	02.00	03.00	04.00	05.00	06.00	07.00	08.00	09.00	10.00	11.00
CBG												
CBK												
Initials												
Date: / /	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00
CBG												
CBK												
Initials												

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Monitoring Record Sheet during management of steroid glycaemia
Variable Rate Intravenous Insulin Infusion (VRIII)

Guide:

Addressograph Label

Only use for patients on intravenous insulin infusion.

Make sure the patient's hands are clean.

Check capillary blood glucose (CBG) hourly and for a further 24 hours after the second corticosteroid administration.

Check capillary blood ketone (CBK) if CBG > 11.0mmol/L or patient is unwell.

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Glycaemic control during labour and birth

Blood glucose monitoring, insulin and oral glucose lowering drugs should continue as usual during the induction of labour.

Once in established labour

- Commence hourly capillary blood glucose monitoring with hospital glucometer.
- Stop mealtime bolus insulin and metformin if taken.
- Continue with long acting basal or intermediate insulin if taken.
- Target capillary blood glucose levels 5.0 – 8.0 mmol/L.
- Check capillary blood ketone if blood glucose > 11.0 mmol/L or if diabetic ketoacidosis suspected.
- If capillary blood glucose < 4.0 mmol/L, treat hypoglycaemia in accordance with hypoglycaemia protocol.
- If capillary blood glucose 4.0 – 5.0 mmol/L advise to take 10g carbohydrate
- Check urea and electrolytes 4-6 hourly if on VRIII to maintain potassium and bicarbonate in target ranges.
- All birthing people who require VRIII and IV infusion, will require a fluid balance chart to be commenced and the hyponatraemia guidance to be followed.

Variable rate intravenous insulin infusion (VRIII)

- Use **Insulin Actrapid 50 units in 49.5 ml of 0.9% Sodium Chloride** via a syringe driver.
- We recommend **0.9% Sodium Chloride with 5% Glucose and 20 mmol/L Potassium Chloride (0.15%)** at a rate of 50 ml/hour as substrate fluid to avoid hypoglycaemia, hyponatraemia and hypokalaemia.
- Additional fluid may be needed in some patients as per clinical need.
- Some fluids, particularly glucose may need restriction in the event of hyponatraemia.
- Insulin without substrate fluids may rarely have to be used.
- Particular care relating to fluid management is needed in those with pre-eclampsia.

Type 1 Diabetes

- Start a VRIII at the time of established labour or active management of labour.

Gestational Diabetes and Type 2 Diabetes

- Start a VRIII if two consecutive capillary blood glucose levels are > 8.0 mmol/L. The second blood glucose should be within 30 minutes after the first reading to prevent delay in starting VRIII.

Insulin pump therapy

- Women on insulin pumps may prefer to use them during labour and birth provided that blood glucose levels remain stable between 5.0 and 8.0 mmol/L and patient is able to manage insulin pump and monitoring requirements. The diabetes specialist team must be informed of admission.

- Women on insulin pump therapy may be converted to VRIII during labour and birth at their request or if problems arise including failure to maintain blood glucose targets between 5.0 – 8.0 mmol/L, development of blood ketones > 1.0 or need for general anaesthetic.

- An intravenous cannula should be inserted at the onset of active labour in case IV access is needed.

- Commence hourly capillary blood glucose monitoring with hospital glucometer.

- Prompt patient to switch to post birth basal rate setting at start of second stage of labour.

    - **Hyperglycaemia**

- If capillary blood glucose is > 8.0 mmol/L a correction bolus of insulin should be administered aiming for a capillary blood glucose between 5.0 - 8.0 mmol/L.

- After 1 hour if capillary blood glucose is above 8.0 mmol/L repeat the correction dosage.

- If after further 30 minutes capillary blood glucose is still above 8.0 mmol/L convert to VRIII as per protocol. The insulin pump can remain in place (**in manual mode**) on programmed basal setting.

- If capillary blood glucose > 11.0 mmol/L check blood ketones and start VRIII if blood ketones > 1.0 mmol/L. The insulin pump can remain in place (**in manual mode**) on programmed basal setting.

    - **Hypoglycaemia**

- If capillary blood glucose < 4.0 mmol/L treat hypoglycaemia as per hospital protocol and repeat capillary blood glucose after 10 - 15 minutes to ensure resolution.

- If blood glucose remains < 4.0 mmol/L repeat the above until hypoglycaemia is corrected.

- If the patient has unexplained hypoglycaemic episode reduce the basal rate by 25 – 50% using a temporary basal rate reduction. This rate should continue for the remainder of the labour. If further unexplained hypoglycaemia occurs, then remove insulin pump and start VRIII as per protocol.

Glycaemic control during Caesarean Birth

- Planned caesarean births typically take place in the morning. Patients with diabetes should be early on the list wherever possible.
- The usual dose of basal insulin should be given the night before. Patients will be advised directly by diabetes team if any change is recommended.
- Commence hourly capillary blood glucose monitoring with hospital glucometer once patient is nil by mouth. If general anaesthesia is used commence half hourly capillary blood glucose monitoring until baby is born and mother fully conscious
- Stop mealtime bolus insulin and Metformin if taken.
- Continue with long acting basal or intermediate insulin if taken.
- Target capillary blood glucose levels 5.0 – 8.0 mmol/L.
- Check capillary blood ketone if blood glucose > 11.0 mmol/L or if diabetic ketoacidosis suspected.
- If capillary blood glucose < 4.0 mmol/L, treat hypoglycaemia in accordance with hypoglycaemia protocol.
- Check urea and electrolytes 4-6 hourly if on VRIII to maintain potassium and bicarbonate in target ranges.

Variable rate intravenous insulin infusion (VRIII)

- Use **Insulin Actrapid 50 units in 49.5 ml of 0.9% Sodium Chloride** via a syringe driver.
- We recommend **0.9% Sodium Chloride with 5% Glucose and 20 mmol/L Potassium Chloride (0.15%)** at a rate of 50 ml/hour as substrate fluid to avoid hypoglycaemia, hyponatraemia and hypokalaemia.
- Additional fluid may be needed in some patients as per clinical need.
- Some fluids, particularly glucose may need restriction in the event of hyponatraemia.
- Insulin without substrate fluids may rarely have to be used.
- Particular care relating to fluid management is needed in those with pre-eclampsia.

Type 1 Diabetes

- Start a VRIII on admission.

Gestational Diabetes and Type 2 Diabetes

- Start a VRIII if two consecutive capillary blood glucose levels are > 8.0 mmol/L. The second blood glucose should be within 30 minutes after the first reading to prevent delay in starting VRIII.

Insulin pump therapy

- It is anticipated that the duration of time to undergo this procedure is short i.e. < 2 hours. If diabetes is stable and anaesthetist agreeable the insulin pump can continue during the caesarean birth at the programmed basal rate. The basal rate should be switched to the postnatal basal rate setting once in anaesthetic room.

- Insulin pump cannula site and CGM sensor should be sited away from the operative site and the diathermy pad(s). Steel infusion sets are not advised for peri-operative use.

- Monitor capillary blood glucose hourly with hospital glucometer.

- If capillary blood glucose < 4.0 mmol/L, treat hypoglycaemia in accordance with hypoglycaemia protocol.

- If capillary blood glucose > 8.0 mmol/L a correction bolus of insulin should be administered aiming for a capillary blood glucose between 5.0 - 8.0 mmol/L.

- If capillary blood glucose > 10.0 mmol/L develops convert to a VRIII as per protocol. The insulin pump can remain in place (**in manual mode**) on programmed basal setting.

Intravenous Insulin Prescription and Fluid Protocol

FOR MANAGEMENT DURING LABOUR AND BIRTH

GIG CYMRU NHS WALES — Bwrdd Iechyd Prifysgol Hywel Dda University Health Board

For use during pregnancy, labour and birth for ALL patients receiving Variable Rate Intravenous Insulin Infusion (VRIII)
NEVER use an IV syringe to draw up insulin
ALWAYS draw up insulin using an insulin syringe
ALWAYS continue subcutaneous intermediate and basal insulin
Doctor: All prescriptions for insulin and fluids must be signed
Midwife: All entries must be signed

Ward	Consultant	Admission Date:
		Discharge Date:
Surname		First Name
Hospital Number		Date of Birth / Age
NHS Number		
Address		

DOSING ALGORITHM (Alg) (Please see the guide below)

Algorithm	1	2	3	4
	For most women	For women not controlled on algorithm 1 or needing >80 units/day of insulin	For women not controlled on algorithm 2 (after specialist advice)	Customised scale
CBG Levels (mmol/L)	Infusion Rate (units/hr = ml/hr)			
<5	STOP INSULIN FOR 20 MINUTES. If CBG < 4 treat hypo as per guideline (re-check CBG in 10 minutes)			
5.0 – 5.5	0.5	0.5	1.0	
5.6 – 7.0	0.5	1.0	2.0	
7.1 – 8.5	1.0	1.5	3.0	
8.6 – 11.0	1.5	2.0	4.0	
11.1 – 14.0	2.0	2.5	5.0	
14.1 – 17.0	2.5	3.0	6.0	
17.1 – 20.0	3.0	4.0	7.0	
>20.1	4.0	6.0	8.0	
Signed				
Print Name				
Date				

ALGORITHM GUIDE

- **ALL** women with diabetes should have capillary blood glucose (CBG) testing hourly in established labour, after ARM or on admission for planned caesarean birth.
- Start VRIII and IV fluids if two consecutive CBG > 8.0mmol/L or if the woman has type 1 diabetes

Algorithm 1 Most women will start here
Algorithm 2 Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or patients not achieving target on algorithm 1)
Algorithm 3 Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target CBG level = 5.0 – 8.0 mmol/L

Check CBG every hour whilst on VRIII and every half an hour if under anaesthesia

Move to the higher algorithm if the CBG is > target and is not dropping

Move to the lower algorithm if CBG falls below 5 mmol/L or is dropping too fast, advise to take 10g carbohydrates.

Drug	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date
Actrapid	50 UNITS	Made up to 50ml with 0.9% Sodium Chloride (1 UNIT per ml)	IV			

SYRINGE PREPARATION

Prepared by 2 MW	Date	Time started	Time stopped

INTRAVENOUS SUBSTRATE FLUID PRESCRIPTION

Date Time	Intravenous Fluid and Rate	Alternative Rate	Prescriber's Signature	MW Signature x 2
	500 ml Sodium Chloride 0.9%, Glucose 5% with 20 mmol/L Potassium Chloride (KCL) (0.15%) to run at 50 ml/hr.			
	500 ml Sodium Chloride 0.9%, Glucose 5% with 20 mmol/L KCL (0.15%) to run at 50 ml/hr.			

PRESCRIPTION OF INTRAVENOUS MANAGEMENT OF HYPOGLYCAEMIA

Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		Glucose 10%	**150ml**	**IV**	**10 min**				

GESTATIONAL DIABETES: STOP VRIII and IV substrate fluid regime once placenta is birthed

TYPE 1 DM and INSULIN TREATED TYPE 2 DM
Reduce the rate of VRIII by HALF once placenta is birthed.
Contact diabetes team to review on-going insulin requirements if no arranged plan in notes

Maintain IV insulin for 30 minutes after re-starting original regimen-IV insulin has a 5 minute half life

Monitoring Record Sheet during management of labour and birth
Variable Rate Intravenous Insulin Infusion (VRIII)

Guide:

Only use for patients on intravenous insulin infusion.

Make sure the patient's hands are clean.

Check capillary blood glucose (CBG) hourly during labour and birth.

Check capillary blood ketone (CBK) if CBG > 11.0mmol/L or patient is unwell.

Addressograph Label

Date: / /	00.00	01.00	02.00	03.00	04.00	05.00	06.00	07.00	08.00	09.00	10.00	11.00
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Postnatal Management

Type 1 diabetes or insulin treated type 2 diabetes

- Following birth of the placenta the insulin infusion rate should be reduced by 50% and light meal e.g. tea and toast provided. Hourly capillary blood glucose monitoring should continue whilst on VRIII.
- Recommence sub-cutaneous insulin regime once the patient is eating and drinking. The VRIII should be stopped 30 - 60 minutes after the first subcutaneous mealtime injection.
- Postnatal insulin doses will have been advised by the diabetes team. If no doses are available, the dose reduction should be 50% of late pregnancy doses or a reduction of 25% of the pre-pregnancy doses.
- Once eating normally restart oral glucose lowering medication as advised by diabetes team. Metformin can continue when breastfeeding.
- Monitor capillary blood glucose levels pre-meals, pre-bedtime, and 3am.
- Target capillary blood glucose levels 6.0 – 10.0 mmol/L to avoid hypoglycaemia
- If capillary blood glucose < 4.0 mmol/L, treat hypoglycaemia in accordance with hypoglycaemia protocol.
- Check capillary blood ketone if blood glucose > 14.0 mmol/L or if diabetic ketoacidosis suspected.
- **If breastfeeding / expressing** – encourage healthy eating with increased carbohydrates. Breast feeding and expressing predispose women to hypoglycaemia. Advise women to snack (10 – 15g carbohydrate) and drink each time they feed or express milk (including night feeds). Insulin doses may need reducing if hypoglycaemia is occurring. Consult diabetes team for advice.

Type 2 diabetes not on insulin prior to pregnancy

- Following birth of the placenta intravenous insulin can be stopped.
- Monitor capillary blood glucose levels every 4 hours until eating and drinking.
- Once eating and drinking check capillary blood glucose levels pre meal and pre bed.
- Target capillary blood glucose levels 6.0 – 10 mmol/L
- Once eating normally restart oral glucose lowering medication as advised by diabetes team. Metformin can continue when breastfeeding.

Gestational diabetes

- Following birth of the placenta intravenous insulin can be stopped.
- **Do not** restart subcutaneous insulin or metformin.
- Monitor capillary blood glucose levels every 4 hours until eating and drinking.
- Once eating and drinking check capillary glucose levels pre meal and 2 hours post meal.
- Target capillary blood glucose levels <7.0 mmol/L pre meal and < 11.1 mmol/L post meal. Diabetes specialist team should be informed if capillary blood glucose levels are above target.
- Women should be advised lifestyle changes (including weight control, diet and exercise) and encourage healthy diet choices. Offer enrolment to Baby Steps program and the diabetes prevention program.
- Advise fasting blood glucose check between 6 – 13 weeks postnatal or HbA1c check after 13 weeks postnatal to exclude ongoing diabetes.
- Advise annual check of HbA1c with Primary Health care Team.

Insulin pump therapy

- Check that patient has adjusted pump settings to postnatal blood glucose target (typically 6.5 mmol/L) to programmed postnatal basal rate, postnatal carbohydrate ratio and postnatal insulin sensitivity factor. If these are not known the pre-pregnancy basal rate can be used with a 20% reduction alongside pre-pregnancy carbohydrate ratio and pre-pregnancy insulin sensitivity factor. If pre-pregnancy settings are unknown, consider using basal rate 0.5 units per hour with 1 unit of insulin per 15g of carbohydrate and insulin sensitivity of 1 unit for 4.0 mmol/L.
- Check capillary blood glucose hourly for a minimum of four hours and then pre meals, pre bedtime and 3 am.
- Bolus doses of insulin can restart once eating and drinking.
- If the insulin pump has been discontinued and replaced with VRIII then the insulin pump should restart when eating and drinking normally. The VRIII should continue for 30 – 60 minutes after the first mealtime bolus dose.

All women with pre-existing diabetes should be referred back to their usual diabetes care arrangements.

All women should be reminded of the importance of contraception and the need for preconception care when planning for future pregnancies.

Illness and diabetes in pregnancy

Women with Type 1 diabetes are provided with a home capillary blood ketone meter and advised to check for blood ketones when blood glucose is > 11.0 mmol/L or if they are unwell.

All women with diabetes are advised to contact antenatal ward if unwell or vomiting.

Diabetic ketoacidosis (DKA) is a medical emergency requiring prompt recognition and treatment as it is associated with significant maternal and fetal mortality. Women suspected to have DKA should be managed on the labour ward or high dependency unit where they can receive medical and obstetric care.

In pregnancy DKA can occur at lower levels of hyperglycaemia (> 11.0 mmol/L). Patients in the third trimester are at greatest risk. Intercurrent illness, vomiting, administration of steroid, omission of insulin and insulin pump occlusion/failure can all trigger DKA.

Symptoms include nausea and or vomiting, abdominal pain, polyuria and polydipsia, leg cramps. Later signs include dehydration, blurred eyesight, tachypnoea and tachycardia. DKA should always be considered in a pregnant woman with diabetes who feels unwell. DKA can present as abdominal pain which should be considered as an alternative to preterm labour.

Indications for capillary blood ketone monitoring

- Blood glucose > 11.0 mmol/L
- Urine ketone > 2+
- If patient is unwell
- **Report all capillary blood ketone > 1.0 mmol/L to doctor**

Interpretation of capillary blood ketone levels

0 – 0.6 mmol/L	Normal
0.7 – 0.9 mmol/L	**Increased ketone production. Action needed to prevent progression to DKA.** Encourage oral fluids. Give corrective dose of insulin using insulin pen. Patients on insulin pump therapy must troubleshoot their pump to exclude line occlusion or cannula site failure. Recheck capillary blood ketone levels after one hour. If capillary blood ketone levels increasing start VRIII.
1.0 – 2.9 mmol/L	**High level of capillary blood ketones. Significant risk of progression to DKA.** Start VRIII.
3.0 mmol/L or higher	**Potential DKA.**

- Venous pH and bicarbonate must be checked urgently if capillary blood ketones are > 3.0 mmol/L.

Diagnosis of DKA

- **Presence of diabetes** of any kind. DKA can occur with normal capillary blood glucose levels.
  AND
- **Ketosis** – Blood ketone level > 3.0 mmol/L or urine ketone > 2+
  AND
- **Acidosis** – Bicarbonate < 15 mmol/L and or venous pH < 7.3

Management of DKA

- Consider cause of DKA. Send blood for FBC, Glucose, U&E, LFT, CRP.
- Admit to labour ward.
- Seek urgent senior obstetric and diabetes specialist review (medical registrar out of hours).
- Seek anaesthetic support with low threshold for critical care review.
- Commence adult diabetic ketoacidosis care bundle – **Fixed rate intravenous insulin infusion.**
- These patients require joint obstetric and medical management.
- Aim is 'in utero resuscitation' with maternal stabilisation, hydration and reversal of hyperglycaemia and metabolic acidosis.
- Close maternal monitoring with specific attention to fluid balance.
- Continuous fetal monitoring – abnormalities of fetal heart may improve with improvement of maternal condition.
- Treat underlying cause e.g. infection.

Hyperglycaemia and ketonemia (> 1.0 mmol/L) not meeting DKA criteria

- These patients require intravenous fluid and insulin via variable rate intravenous insulin infusion to prevent further rise in ketone levels.
- **Long acting basal insulin should be continued**.
- They should have hourly capillary blood glucose and blood ketone monitoring.
- Consider potential cause e.g. infection and treat as required.
- Stop IV fluids and VRIII once capillary blood ketones < 0.6 mmol/L for 2 consecutive hours as long as patient is eating and drinking.
- They should receive specialist diabetes review (medical registrar out of hours)

VRIII Management Guidelines

- Use Insulin **Actrapid 50 units in 49.5 ml of 0.9% sodium Chloride** via a syringe driver.
- We recommend **0.45% Sodium Chloride with 5% Glucose and 20 mmol/L Potassium Chloride (0.15%)** at a rate of 125ml/hour as a substrate fluid to avoid hypoglycaemia, hyponatraemia and hypokalaemia.
- If hyponatraemia without symptoms we recommend **0.9% Sodium Chloride with 5% Glucose and 20 mmol/L Potassium Chloride (0.15%)** at a rate of 125ml/hour.
- Adjust the VRIII as required according to the infusion rate table.
- Review the capillary blood glucose trend within 6 hours to make sure capillary blood glucose are within recommended target range.

- Check electrolytes daily (at risk of hyponatraemia and hypokalaemia).
- Review the need for VRIII at least once daily.
- Aim to achieve capillary blood glucose **5.0mmol/L to 8.0mmol/L**, however 6.0mmol/L to 10.0mmol/L is acceptable.
- Review the fluid status daily.

Suggested Insulin Infusion Rates (adapted from CPOC 2021)

Glucose mmol/L	Insulin Rates (ml/hour) Start on standard unless otherwise indicated				
N.B. if a Patient is on basal subcutaneous Insulin continue this alongside VRIII					
	Reduced rate (RR) (for use in insulin sensitive patients e.g. <24 units per day or insulin naive	**Standard rate (SR) (first choice in most patients)**	**Increased rate (IR) (for insulin resistant patients >100 units per day)**	**Customised scale 1 (CS1)**	**Customised scale 2 (CS2)**
<5.0	*0	*0	*0		
5.1-8.0	0.5	1	2		
8.1-11.0	1	2	4		
11.1-15.0	2	4	6		
15.1-20.0	3	5	7		
20.1-28.0	4	6	8		
>28.1	6	8	10		
Signature, date & bleep number of prescriber					
*Treat Hypoglycaemia and **restart IV insulin within 20 minutes**. The half-life of intravenous insulin is very short (five minutes) and restarting the VRIII promptly minimises the risk of ketoacidosis.					

Stopping the VRIII

- Stop IV fluids and VRIII once capillary blood ketones < 0.6 mmol/L for 2 consecutive hours as long as patient is eating and drinking.
- Restart usual diabetes bolus insulin with a meal.
- If basal insulin has been stopped (**not recommended**) this must be given before stopping the VRIII.
- If the basal insulin was stopped and is not due for several hours consider administering half the usual basal insulin dose before stopping VRIII.
- If patient uses insulin pump ask patient to restart their usual basal rate and administer bolus dose of insulin with a meal.
- Do not stop VRIII for 30 – 60 minutes after bolus insulin has been given and meal eaten.

Monitoring Record Sheet during management of Variable Rate Intravenous Insulin Infusion (VRIII)

Guide:

Only use for patients on VRIII, unwell with hyperglycaemia.

Do not use this chart for DKA.

DKA use Adult DKA care bundle.

Addressograph Label

Make sure the patient's hands are clean.

Check capillary blood glucose (CBG) hourly and for a further 6 hours after the discontinuation of VRIII once CBG and capillary blood ketone (CBK) within normal range.

Aim for CBG range 5.0mmol/L – 8.0mmol/L (acceptable CBG range 6.0 – 10.0 mmol/L.

Aim for CBK < 0.6mmol/L.

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