Diabetes in Pregnancy- Full Clinical Guideline

Reference no.: UHDB/01:24/D1

Contents

1. Introduction

Women with Type 1 and Type 2 diabetes have persistently high perinatal mortality with no improvement over the past 5 years. Contemporary annual data from the mandatory National pregnancy in diabetes audit (NHS Digital) (Lancet D&E 2021) in England & Wales shows that perinatal loss in diabetes is 4-5 times higher than the background population: In women with Type 1 diabetes, stillbirth occurs in 10·4 per 1000 livebirths and stillbirths, with neonatal death occurring in 7·4 per 1000 livebirths; In women with Type 2 diabetes it is even higher – stillbirth occurs in 13·5 per 1000 livebirths and stillbirths, with neonatal death occurring in 11·2 per 1000 livebirths. The risk of perinatal mortality is highest in women who are the most socioeconomically deprived (increased 2-fold) and those who have suboptimal glucose control in the third trimester (increased 3 fold). As women with diabetes are more socioeconomically deprived and more likely to be of South Asian and Black ethnicity than pregnant women without diabetes, there is an urgent need to address these inequalities.

Diabetes in pregnancy is associated with risks to the woman and to the developing fetus. Miscarriage, pre-eclampsia and preterm labour are more common in women with pre-existing diabetes. In addition, diabetic retinopathy can worsen rapidly during pregnancy. Stillbirth, congenital malformations, macrosomia, birth injury, perinatal mortality and postnatal adaptation problems (such as hypoglycaemia) are more common in babies born to women with pre-existing diabetes (NICE NG3 2015).

The multidisciplinary team (MDT) consists of:

Consultant Endocrinologist
Diabetes Specialist Nurses
Specialist Dietician
Obstetric Consultant
Diabetes Specialist Midwife

2. Scope of guideline

This guideline is relevant to all women who have pre-existing (including Type 1, Type 2, Type 3c and monogenic causes of diabetes, all women who develop gestational diabetes (GDM), and also women who have risk factors for screening for gestational diabetes. The following aspects of care are covered:

- Pre-conceptual care for women with pre-existing diabetes
- Antenatal care, including screening for and diagnosis of GDM
- Intrapartum care
- Care of the mother in the postnatal period up to six weeks

Care of the neonate is outside the scope of this guideline.

3. Abbreviations

AC	-	Abdominal Circumference
ACR	-	Albumin Creatinine Ratio
ANC	-	Antenatal Clinic
AVPU	-	Alert, Verbal, Painful, Unresponsive
BG	-	Blood Glucose
BMI	-	Body Mass Index
CGM	-	Continuous glucose monitoring
CLC	-	Consultant Led Care
CSII	-	Continuous subcutaneous insulin infusion (insulin pump)
DOC	-	Diabetic Obstetric Clinic
EDD	-	Estimated Date of Delivery
FBS	-	Fasting blood sugar
GMI	-	Glucose management index
GDM	-	Gestational Diabetes Mellitus
GTT	-	Glucose Tolerance Test
HbA1c	-	Glycosylated Haemoglobin
HBGM	-	Blood Glucose Monitoring
HCL	-	Hybrid closed loop
HDU/EHC	-	High Dependency Unit/ Enhanced care unit
IUGR	-	Intrauterine Growth Retardation
IV	-	Intravenous
FNCH	-	Florence Nightingale Community Hospital
LSCS	-	Lower Segment Caesarean Section
LW	-	Labour Ward
MWLC	-	Midwife Led Care
NT+	-	Nuchal translucency plus
PCC	-	Pre-Conceptual Counselling
PET	-	Pre-eclampsia
PROCEED	-	Preconception Care for Diabetes in Derby and Derbyshire
VRIII	-	Variable rate Intravenous insulin infusion
TIR	-	Time in range
TBR	-	Time below range
DPP	-	Diabetes prevention programme

4. Documentation

Ensure all assessments and individual plans of care and review of glucose data are documented clearly in the appropriate records which may include some or all of those listed below

· Medical records (up to EDD prior to 24th September 2024)

· Maternity hand held records (up to EDD prior to 24th September 2024)

· Maternity electronic Patient Records systems

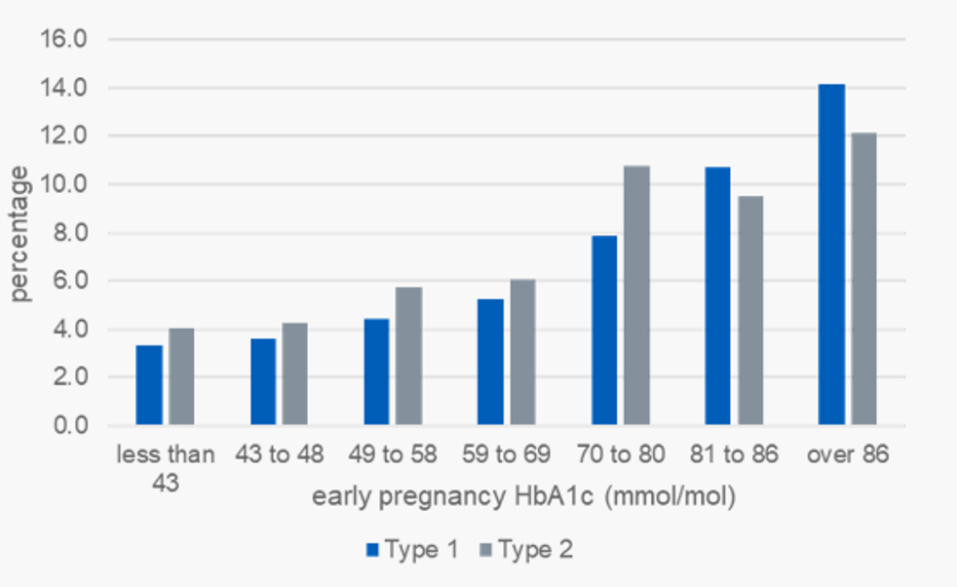
5. Organisation of care

5.1. Pre-conceptual counseling

We have had evidence that preconception care reduces congenital abnormalities in women with diabetes for over 30 years. Data from the North East demonstrates a linear relationship between glucose and congenital abnormalities, so any improvement in glucose control in the preconception period reduces risks. Despite this evidence only a third of women accessed this care at the time of the CEMACH audit, and the more recent National Diabetes in pregnancy audit showed that only 15.4% of those with type 1 diabetes and 35.8% with Type 2 achieved NICE recommended glucose targets, and less than half took folic acid as recommended prior to conceiving. In addition, with 50% of pregnancies being unplanned it is important that all clinicians in contact with women with diabetes of childbearing age remind them of the importance of planning pregnancy and advise on contraception use.

Women with diabetes who are planning a pregnancy should be referred to the appropriate pre-conception care clinic, ie PROCEED for Derby women, Endocrinologist at QHB.

- Women will be counselled as to the risks of diabetes and pregnancy and how to reduce these risks, particularly including the risk of neural tube defects and congenital abnormalities and the relationship of these to glucose levels. Data from the National Pregnancy in Diabetes Audit highlight the relationship between HbA1c at the start of pregnancy and the risk of adverse pregnancy outcomes (congenital malformations and still birth or neonatal death):



- Women will be counselled as to the impact of weight on fertility, diabetes control and risks for pregnancy if appropriate.
- They will be supported to achieve glucose levels as near to the non-diabetic range as possible without problematic hypoglycaemia.
- Individualised HbA1c and/or TIR targets will be set. Recommended HbA1c target is <48mmol/mol.
- Offer women with Type 1 diabetes who are planning pregnancy with the option to start hybrid closed loop therapy prior to conception
- Folic Acid 5mg is prescribed.
- Medication reviewed and if needed changed to drugs that are safe in pregnancy. Particular drugs which should be considered are; statins, ACE inhibitors, Angiotensin-2 receptor blockers, SGLT-2 inhibitors and GLP-1 analogues. (Sulphonylureas & Pregnancy // Diabetes Genes)
- Women with diabetes may be advised to use metformin as an adjunct or alternative to insulin in the preconception period and during pregnancy, when the likely benefits from improved blood glucose control outweigh the potential for harm. Stop all other oral blood glucose lowering agents before pregnancy, and use insulin instead (Note that this is an off-label use of metformin. See NICE's information on prescribing medicines(.
- Complications and co-morbidities are optimised.
- Smoking cessation advice will be given.
- Women with significant proteinuria (PCR>30) or CKD 3 or more are referred to a nephrologist prior to pregnancy.
- Retinal screening is updated and if a woman is seeing ophthalmology or has referable retinopathy the ophthalmologist is made aware that she is planning pregnancy.

- Women are given an information sheet with contact numbers and email addresses for advice and to inform us when they are pregnant. Email uhdb.antenataldiabetesteam@nhs.net and uhdb.diabetesmidwives@nhs.net

5.2. Pregnancy and pre-existing diabetes

The aim of care for women with pre-existing diabetes is to empower them to have a positive experience of pregnancy and childbirth, by providing information, advice and support that will help to reduce the risks of adverse pregnancy outcomes for mother and baby. Good pre-conception care and planning is important, but it is recognised that many women will present for antenatal booking in an unplanned pregnancy.

We ask women to contact us as soon as they know they are pregnant. Health professionals should refer women urgently the same day by contacting the Diabetes Specialist Midwives or ANC in their absence.

They will be reviewed by a member of the diabetes antenatal team ASAP. If the woman has not received preconception care:

- Start Folic Acid 5mg daily
- Stop Statins and any diabetes medications except insulin, metformin.
- Medication is reviewed and medication that is safe or recommended for use in pregnancy prescribed.
- Use isophane insulin (also known as NPH insulin) as the first choice for long acting insulin during pregnancy. Consider continuing treatment with long acting insulin analogues (insulin detemir or insulin glargine) for women with diabetes who have established good blood glucose control before pregnancy (Note that this is an off-label use of long-acting insulin analogues. See NICE's information on prescribing medicines).
- Women will also be verbally consented for submission of their data to the National Pregnancy in Diabetes audit (NPID)
- Counselling about diabetes and pregnancy should be provided to include the same issues which would have been discussed in preconception.
- Where possible and safe, blood glucose targets are fasting glucose <5.3mmol/l, and 1 hour post prandial <7.8 mmols. Advise pregnant women taking Insulin to maintain their blood glucose level above 4 mmol/l and those using CGM to aim for>70% time in range in the targets 3.5-7.8mmol/l, with <4% glucose <3.5mmol/l
- Those with Type 1 diabetes will be counselled as to the risks of hypoglycaemia in pregnancy and in particular loss of warning signs of hypoglycaemia in pregnancy. They will be asked to obtain a supply of Glucogel and their partner instructed on the use of Glucagon. Women will be made aware of the increased risk of ketoacidosis, given blood ketone monitoring and counselled as to when to check for ketones and seek advice.

- If women are not already using diabetes technologies, offer CGM to all ladies with pre-existing diabetes on insulin and hybrid closed loop therapy including real time continuous glucose monitoring to ladies with Type 1 diabetes.
- Women should be provided with appropriate education and support to use the diabetes technology provided to them.
- Women with type 2 diabetes should have an objective record of their blood glucose recorded in their hospital records/EPR and be offered alternatives (e.g., intermittently scanned CGM) to blood glucose monitoring if glycaemic targets are not achieved.
- Metformin is used (before insulin) to treat Type 2 diabetes where diet and lifestyle alone is insufficient.
- Women have their glucose reviewed as often as needed to achieve TIR target glucose levels in line with national and international guidance. This is usually weekly but at least fortnightly.
- Review may be face to face, by telephone or by reviewing profiles remotely.
- Documentation of the following should occur in the clinical notes at every consultation, TIR, TBR, Average glucose, current diabetes treatment and doses and for those using insulin pump therapy or hybrid closed loop therapy, total daily dose of insulin.
- If women with pre-existing diabetes are not meeting their glycaemic targets, then their case should be discussed with a diabetes consultant experienced in antenatal diabetes and diabetes technologies.
- Women with significant complications of their diabetes, particularly those with autonomic neuropathy or cardiac disease or other concerns identified by the treating consultant diabetologist, or obstetrician should be referred to the Midlands maternal medicine network diabetes and endocrinology MDT.
- HbA1c, ACR, U&E's and thyroid function are checked at first visit,and repeated as clinically indicated. HbA1c and U&E are also checked in the early 3rd trimester (28 weeks)
- Interpretation of the 3rd trimester HbA1c should be as in the following table. It is likely that these ladies are already receiving frequent contact and will be being seen in the joint antenatal clinic.

Green	HbA1c 43 mmol/mol or less	Continue current care
Amber	HbA1c 44-48 mmol/mol	Consider additional input to improve glucose management
Red	HbA1c more than 48 mmol/mol	MDT discussion required. Offer additional input to improve glucose management including alternative methods of monitoring treatment. Offer increased foetal surveillance, at least fortnightly

		from 32 weeks and re-discuss increased risk of stillbirth, birth and neonatal complications.

5.3. Retinal Screening

- Initial screening should occur within the first trimester
- As soon as the diabetes antenatal team are notified of pregnancy contact Derbyshire eye screening via email uhdb.despfailsafe@nhs.net or Staffordshire eye screening via email Diabeticeye@mpft.nhs.uk or Leicestershire eye screening via email LLRDESP@uhl-tr.nhs.uk informing them of pregnancy and gestation. They will then organize all screening required in pregnancy. If the lady is already under eye clinic then contact ophthalmology secretaries or consultant by urgent letter or email. Timing of the next assessment will depend on the initial findings as follows:
    - no retinopathy – offer rescreening at 28 weeks
    - non-referable retinopathy - invite for re-screening at 16-20 weeks gestation
    - referable retinopathy (pre proliferative or proliferative) - screening centre will make appropriate referral.
- Diabetic retinopathy should not be considered a contraindication to rapid optimisation of blood glucose control in women who present with high HbA1c in early pregnancy.
- Diabetic retinopathy should not be a contraindication to vaginal birth.
- Women with retinopathy requiring treatment in pregnancy should be referred to the dedicated RDH site antenatal clinic for women with pre-existing diabetes.
- Women with pre proliferative or proliferative retinopathy or any form of referable retinopathy diagnosed during pregnancy should have ophthalmological follow-up for at least 6 months after the birth of the baby.

5.4. Renal Assessment

- Offer renal assessment in the form of a blood test for U&E and a first morning urine sample for albumin/creatinine ratio at first contact in pregnancy unless it has been done in the previous 3 months
- Consider referral to a nephrologist if:
    - Serum creatinine > 120 micromol/l or
    - Urinary ACR > 30mg/mol or o Total protein excretion exceeds 2g/day
- Nephrotic range proteinuria (>3g/day) significantly increases VTE risk and needs to be taken into account during VTE risk assessment, in accordance with current VTE guideline.
- Repeat U&Es in the third trimester.
- All women with CKD2 with significant proteinuria (PCR>30) and CKD3 or higher should be referred to the dedicated RDH site antenatal clinic for women with pre-existing diabetes

5.5. Consultant led Obstetric and Diabetes MDT Care for those with Pre-Existing Diabetes

Women are advised to inform the diabetes antenatal team as soon as they know that they are pregnant . They will be seen in the next diabetes obstetric clinic. They should also see the Community Midwife for an early booking appointment and have regular contact with the community midwifery team throughout their pregnancy.

- A viability scan is arranged at 8 weeks when the woman will be reviewed by the diabetes team.
- Women will be managed in the dedicated consultant led MDT clinic specifically for women with pre-existing diabetes.
- Dating scan arranged at 11+2 – 14+1 weeks to include the opportunity of nuchal translucency (NT +) antenatal screening. If they miss the nuchal screening they will be offered second trimester serum screening and made aware of its high false positive rate in diabetic pregnancies.
- A Joint obstetric and diabetes booking visit to coincide with their dating USS, will stratify the woman's risks and provide an opportunity to make a joint management plan for pregnancy.
- At this appointment the following information will be revisited:
    - Establishing and maintaining good glucose control through pregnancy will reduce the risk of miscarriage, congenital malformation, stillbirth and neonatal death although cannot eliminate it
    - The role of diet, body weight and exercise
    - How nausea and vomiting can affect blood glucose control, and "sick day" rules
    - The increased risk of having a baby large for gestational age, which increases the likelihood of birth trauma, induction of labour and Caesarean section.
    - The importance of maternal blood glucose control during labour and birth and early feeding of the baby, in order to reduce the risk of neonatal hypoglycaemia
    - The possibility of temporary health problems in the baby during the neonatal period, which may require admission to the neonatal unit.
    - Take blood for HbA1c, to ascertain more specific level of risk (pre-pregnancy women should be aiming for HbA1c below 48 mmol/mol (6.5%)
    - Offer verbal and if necessary, written information about the NHS Digital National Pregnancy in Diabetes (NPID) Audit, prior to obtaining verbal consent for inclusion
- Start Low Dose Aspirin 150 mg (as per AN care guideline) from 12 weeks and continue up to 36 weeks. If the patient is on low molecular weight heparin then aspirin dose should be reduced to 75mg daily.
- Review thromboembolic risk and prescribe anticoagulation as indicated

- An anomaly scan, with views of fetal cardiac outflow tracts, is undertaken at 20/40 and patient reviewed. If views are inadequate a 23 week ultrasound scan to be performed by a member of fetal medicine team
- Growth USS and DOC appointments at 28 weeks, 32 weeks, 34 weeks, and 36 weeks gestation as a minimum with surveillance for PET. At each of these appointments the woman will be seen jointly by a member of both the diabetes and obstetric teams.
- Weekly-Fortnightly contact with diabetes team for glucose optimisation
- Joint Obstetric and Diabetic DOC appointment at approximately 36/40 to make a plan for delivery and also to discuss postnatal diabetes management and review other medication.
- Women should be delivered by 38+6, (IOL should be planned at 37-38 weeks)
- For women with diabetes and co-morbidities, offer an appointment with the Obstetric Anaesthetist in the third trimester

This plan for antenatal care is revised, taking into account an individual's needs and the possible complications that may arise in these high-risk pregnancies, as per below

  - Polyhydramnios
  - Unstable lie
  - Infection (UTI/Thrush)
  - PET (2 fold increase)
  - Macrosomia
  - IUGR
  - LSCS rate of nearly 70%
  - Shoulder dystocia
  - Retinopathy
  - Nephropathy
  - Hypertension
  - Premature delivery
  - Stillbirth
- Corticosteroids - All women between 24-34 weeks of gestation who are at risk of pre-term birth within the next 7 days should be given antenatal corticosteroids (FIGO 2019).
- In women between 34 and 36 weeks of gestation at risk of pre-term birth, antenatal corticosteroids should be discussed.
- In those women who are having a planned pre-labour caesarean section up to 37+0 corticosteroids should be offered. Between 37-39 weeks, women should be offered the information leaflet on steroids, discussing the pros and cons of steroids at this gestation.
- Glucose monitoring postnatally will be individualized

6. Management of Diabetic Ketoacidosis in Pregnant Women

- Women with all types of diabetes should be advised to seek urgent medical advice if they become hyperglycaemic or unwell.
- The thresholds for developing ketosis are lower in pregnancy and not well tolerated by a foetus.
- If a lady with Type 1 diabetes is unwell then they should be advised to check blood ketone levels even if glucose levels are normal. If blood ketone levels are >1.5mmol/l then women should be advised to seek urgent medical help.
- If the team are contacted by a patient and suspect DKA, sick day rules for extra insulin administration as per TREND guidance should be advised and if below 20 weeks the patient should be admitted to either the emergency department or Medical assessment unit at Derby or Acute Medical Unit at Burton. After 20 weeks gestation the patient should be advised to attend Pregnancy Assessment Unit at Derby or Maternity Assessment Unit in Burton. The team member taking this call should contact the unit concerned to let them know that the patient is on their way and the importance of rapid assessment and management.
- DKA can be accelerated during pregnancy and is associated with 15% maternal and up to 50% fetal mortality.
- Test urgently for ketonaemia if a pregnant woman with any form of diabetes presents with hyperglycaemia or is unwell, to exclude diabetic ketoacidosis.
- **DKA IS A MEDICAL EMERGENCY AND TREATMENT CANNOT WAIT. KETONES KILL BABIES**
- Contact the diabetes team for urgent review in normal working hours, or if unavailable, contact the on-call Medical Consultant or Registrar. Start treatment as per the DKA policy below.
- Below 20 weeks gestation women should be managed on medical HDU or ITU with the care being led by the medical team.
- After 20 weeks gestation women should be admitted to labour ward ECU for management. However, treatment should be commenced as soon as DKA is diagnosed rather than waiting for transfer to another area. The medical team, as well as the obstetric team will be expected to see the patient on labour ward ECU. Consider contacting the critical care outreach team for support with these patients.

Click here for full UHDB DKA guidelines

7. Glucose Monitoring and treatment following Steroid Administration

- Corticosteroids - All women between 24-34 weeks of gestation who are at risk of pre-term birth within the next 7 days should be given antenatal corticosteroids (FIGO 2019).
- In women between 34 and 36 weeks of gestation at risk of pre-term birth, antenatal corticosteroids should be discussed.

- In those women who are having a planned pre-labour caesarean section up to 37+0 corticosteroids should be offered. Between 37-39 weeks, women should be offered the information leaflet on steroids, discussing the pros and cons of steroids at this gestation.

For women undergoing planned caesarean birth between 37+0 and 38+6weeks an informed discussion should take place with the woman about the potential risks and benefits of a course of antenatal corticosteroids. Although antenatal corticosteroids may reduce admission to the neonatal unit for respiratory morbidity, it is uncertain if there is any reduction in respiratory distress syndrome, transient tachypnoea of the newborn or neonatal unit admission overall, and antenatal corticosteroids may result in harm to the neonate which includes hypoglycaemia and potential developmental delay.

- Women should be admitted as steroids can cause significant elevations in blood glucose starting from 6-12 hours after the initial dose continuing for 12- 24 hours after the second dose.
- Women can eat and drink whilst on steroids even if IV insulin is needed
- Monitor fasting and 1 hour post meal blood glucose, using a hospital meter, up to 12 hours after the second dose of steroids.. Do not use the woman's meter, or their Libre/Dexcom sensor readings as these are not accurate enough for making clinical decisions.
- Commence IV variable rate insulin infusion (VRIII or "sliding scale") if 2 consecutive glucose levels are >5.3 fasting or >7.8 post meal until the 12 hours after the 2nd dose of steroids
- Prescribe the following
- **Fluids to run with VRIII (Both sites)**

1st line ideal fluids:
5% glucose & 0.9% sodium chloride with 0.15% KCL (10mmols potassium) 500ml bag @ 50mls/hr.

If unavailable substitute with the following fluids:
4% glucose, 0.18% NaCL with 20mmols KCL(potassium per litre) @50mls/hr.

- **IV insulin prescription (Both sites)**

  50 units human soluble insulin in 50mls Sodium Chloride 0.9%

- **<u>CONTINUE ALL EXISTING DIABETES TREATMENT (All insulin and metformin)</u>**
- Check U&E at the time of starting VRIII and adjust potassium replacement in fluid as required. If on VRIII for >24 hours then recheck U&E every 24 hours.
- Check for ketones if glucose is >10mmol/l.or if patient is unwell
- Check capillary glucose every hour when on IV variable dose insulin. Target glucose is 4-7.8.

- Continue VRIII for 12 hours after last dose of steroids. The VRIII can be stopped if ketones are <0.6 and if blood glucose levels are stable on 1 unit/hour of IV insulin. If these parameters are not met the diabetes midwives or diabetes team should be contacted.
- Ensure women are stable on regular treatment before discharge.

VRIII guidance in chart below (JBDS guidance) **VRIII for use during administration of antenatal steroids (NICE recommended targets): Flash or CGM glucose levels should not be used for insulin dosing during VRIII**

Algorithm →	1	2	3	4
Finger prick BG 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/h = mL/h)			
<4	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
4.0 – 5.5	0.2	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	

ALGORITHM GUIDE

- Start VRIII and Fluids if BG levels are > target on 2 consecutive readings and continue for up to 12 hours after the last dose
- **ALL** women with diabetes should have hourly blood glucose (BG) monitoring while on VRIII for the management of steroid hyperglycaemia during pregnancy

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 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)

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

Target BG level = 4.0 – 7.8 mmol/L

Check BG every hour whilst on VRIII

Move to the higher algorithm if the BG is above target and is not dropping

Move to the lower algorithm if BG falls below 4.0 mmol/L or is dropping too fast

Women on insulin pumps/hybrid closed loop systems

- Rarely need IV insulin
- Have an individualized plan for their insulin rates. The advice below provides some general guidance.
- **If a woman is using an insulin pump (not HCL)**
    - 5 hours after 1st steroid dose start a 50% increase temporary basal rate (150% of usual basal) and increase mealtime boluses by 50% (use bolus calculator as normal, then work out 150% and override)
    - Use additional corrective doses using the bolus calculator. These can be given every hour as needed
    - Continue increased doses for 12-24 hours post 2nd dose of steroids
- If glucose levels climb despite a progressive increase in pump insulin infusion rates, contact a member of the diabetes team and if out of hours consider variable rate insulin infusion (VRII or “sliding scale”), in addition to pump therapy

- **If woman is on hybrid closed loop therapy:**

- CAM APS app
    - Advise to reduce personal glucose target to 4.5
    - Use Boost function liberally
    - If needed extra manual corrections can be given while boost is running via the bolus calculator
    - Diabetes team to review need to strengthen insulin to carbohydrate ratios
    - If not successful than advise to exit automode and go into manual mode and set 150% TBR and increase boluses by 50% (as per pump guidance)
    - If the above measures do not keep glucose in target then start VRIII
    - Hybrid closed loop should be stopped while on VRIII but the pump continued with standalone basal running
    - When ready to stop VRIII then the pump should be run as stand alone basal rate (not in HCL) for an hour while the VRIII is also running and after an hour the VRIII can be removed and the hybrid closed loop system restarted.
    - When restarting hybrid closed loop- change personal glucose target back to 5 and change insulin to carbohydrate ratios back to the pre-steroid ratios.

Medtronic 780g system

- Ensure smartguard target is set at 5.5
- Encourage patient to use manual corrections (press down arrow on home screen)
- Consider changing active insulin time to 2 hours or 2.5 hours
- Diabetes team to review need for stronger insulin:carbohydrate ratios

- If not successful than advise to exit automode and go into manual mode and set 150% TBR and increase boluses by 50% (as per pump guidance)
- If the above measures do not keep glucose in target then start VRIII
- Hybrid closed loop should be stopped while on VRIII but the pump continued with standalone basal running
- When ready to stop VRIII then the pump should be run as stand alone basal rate (not in HCL) for an hour while the VRIII is also running and after an hour the VRIII can be removed and the hybrid closed loop system restarted. If the patient has been out of smartguard for >48 hours then run as standalone basal for at least 48 hours prior going back into smartguard (hybrid closed loop).

8. Gestational Diabetes

8.1. Risk Assessment

Offer a 75g OGTT at 24-28 weeks gestation to those who have one or more of the risk factors at booking listed below:

Women who have been diagnosed with “pre-diabetes”-(HbA1c 42-48 mmol/l) prior to their pregnancy should be referred to the diabetes antenatal clinic as soon as pregnancy is confirmed to commence blood glucose monitoring. They do not require an OGTT

Midwife booking risk assessment:

- BMI > 30.0kg/m2
- First degree relative with type 1 or type 2 diabetes
- Previous gestational diabetes (Screen as soon as possible after booking and repeat at 24-28 weeks if the early pregnancy OGTT is normal)
- Previous unexplained stillbirth
- Previous baby ³ 4.5 Kg
- Family origins with a high prevalence of gestational diabetes - South Asian (specifically women whose country of family origin is India, Pakistan or Bangladesh), black Carribean, black African, and Middle Eastern (specifically women whose country of family origin is Saudi Arabia, United Arab Emirates, Iraq, Jordan, Syria, Oman, Qatar, Kuwait, Lebanon or Egypt).
- PCOS
- **Consultant booking risk assessment additionally:**
- Taking medication that could impair glucose tolerance, such as glucocorticoids and anti-psychotics eg Quetiapine

Additional screening for GTT is clinically indicated up to 34 weeks gestation, if women develop any of the following during pregnancy, if greater than 14 days since last GTT:

- Abdominal circumference (AC)over the top centile, or significant growth acceleration of AC in present pregnancy, **compared to HC**.
- Estimated fetal weight over the top centile
- Ultrasound diagnosed polyhydramnios.
- Glycosuria 1+ on more than one occasion or 2+ or more on 1 occasion

If there are additional obstetric concerns after 34 weeks gestation, 1 weeks blood glucose monitoring can be offered to assess glycaemic control, **following discussion with the diabetes team**.

8.2. Glycosuria

After 34 weeks, new glycosuria is unlikely to be due to elevations in blood glucose as HPL levels would have been expected to have reached their peak, a borderline GTT may be hard to interpret as the normal glucose range is not known for this gestation, and diabetes intervention is unlikely to influence outcome of the pregnancy at this late gestation. Therefore, unless there are additional obstetrics concerns suggestive of elevations in glucose (e.g. accelerations in growth or polyhydramnios), a GTT is not recommended. If there are additional obstetric concerns, 1 weeks blood glucose monitoring can be offered to assess glycaemic control, following discussion with the diabetes team.

If a lady has had a normal GTT due to glycosuria and the glycosuria has not changed, they do not need a repeat GTT unless there are other concerns.

8.3. Glucose Tolerance Test Procedure

The women are to be given the appropriate information leaflet prior to the test (see NET-i)

- They are to be advised to have nothing to eat or drink for 10 hours prior to test commencing (plain water may be drunk if the woman is thirsty)
- Plasma glucose fasting blood sample is to be taken the day of the test
- The woman will then be given a 75g glucose load to drink
- A plasma glucose sample is to be taken 2 hours after the 75g glucose drink
- The woman must be advised to rest between blood tests and not smoke as these can affect the test results
- After the completion of the test women must be advised to eat and drink as soon as possible.

8.4. Interpretation of GTT

Diagnose GDM if the woman has either:

- a fasting plasma glucose ³ 5.6 mmol/l

OR

- a 2-hours plasma glucose level ³ 7.8 mmol/l

OR

- More than 2 abnormal glucose levels on a week of Capillary blood glucose monitoring

8.5. Management of GDM

- Transfer care to the joint Obstetric and Diabetes clinics
- Inform woman of abnormal result and arrange to see in GDM education group or 1:1 as soon as possible if not suitable for group.
    - Counselled as to risks of GDM
        - Risks including fetal macrosomia
        - Trauma during birth to her and/or her baby
        - Neonatal hypoglycaemia, perinatal death, induction of labour and Caesarean section, risk of obesity and/or diabetes to baby in later life.
        - Good blood glucose control will reduce these risks.
        - Maternal risk of type 2 diabetes in years following pregnancy.
        - Treatment includes changes in diet and exercise, and could involve medicines
    - Provided with initial dietary advice and support
    - Provided with literature/signposted to websites
    - Set up on GDm-Health
    - Shown how to perform a blood glucose check and inform of targets
        - Fasting BG <5.3 mmol/l
        - Pre-meal (if on insulin) 4-5.5 mmol/l
        - 1 hour post meal <7.8 mmol/l
    - Commence basal insulin and metformin modified release 500mg od if fasting blood glucose more than 7 on GTT.
    - If fasting glucose 6.0-6.9 and complications such as macrosomia or polydramnios start basal insulin and metformin MR 500mg once daily with evening meal.
    - Women may be sent home with a prescription for Metformin MR and information on commencing and titration if necessary
    - Follow up appointments arranged for obstetric and diabetic review
    - HBA1C and U&E taken/form given, to be performed at earliest opportunity

- Growth scans 4 weekly
- Regular contact with the diabetes team with remote review of blood glucose readings via GDm-Health.
- If glucose levels are unstable and causing concern or problematic/ severe hypoglycaemia then consider CGM following discussion with the diabetes consultant.
- Tailor blood glucose-lowering therapy to the blood glucose profile and personal preferences of the woman with GDM. Treatment options include lifestyle advice, metformin and insulin.
- Joint Obstetric and Diabetes clinic appointment at approximately 36/40 to make a plan for delivery and also discuss intrapartum and postnatal management.
- At this appointment women should be provided with a form for a HbA1c to be taken 12 weeks postnatally. The diabetes prevention program (DPP) should be discussed, and the patient verbally consented for us to refer if postnatal HbA1c is <48mmol/mol
- Aim to plan delivery from 39 weeks to 40+6 weeks, considering comorbidity, fetal growth and wellbeing and glucose control.
- Unless otherwise specified all women with GDM should have glucose lowering therapy stopped at the time of delivery

9 Intrapartum Care for all women with Diabetes

9.1 Spontaneous labour

- Women with diabetes have an increased risk of intrapartum complications and should be reviewed by the obstetric team on the ward round twice daily, with a clear plan for intrapartum care.
- Continuous electronic fetal monitoring is recommended to all women in spontaneous labour. If CTG abnormalities are present and there is no significant maternal hyperglycaemia, fetal blood sampling should be carried out as usual.
- **If a woman has diet controlled gestational diabetes with no other complications and is in spontaneous labour they are suitable for the birth centre and suitable for intermittent auscultation rather than Continuous monitoring.** Once in established labour, monitor BG levels hourly.
- Commence IV variable rate insulin infusion (VRII or “sliding scale”) if 2 consecutive glucose levels are >7 mmol/l. After the first reading of >7 the second reading should be performed within 60 minutes. If a second reading is >7 then start VRIII
- Prescribe the following:
- **Fluids to run with VRIII (Both sites)**
- **1st line ideal fluids:**
- 5% glucose & 0.9% sodium chloride with 0.15% KCL (10mmols potassium) 500ml bag @50mls/hr.
-

- **If unavailable substitute with the following fluids:**
- 4% glucose, 0.18% NaCL with 20mmols KCL(potassium per litre) @50mls/hr.

- **IV insulin prescription (Both sites)**
    - 50 units human soluble insulin in 50mls Sodium Chloride 0.9%
- Check U&E at time of starting VRIII and then if on VRIII >6 hours recheck every 6 hours.
- Follow variable rate protocol below.
- For women using multiple daily injections of insulin,"basal/bolus", the basal long acting insulin should be continued while the woman is on VRIII
- Additional Intravenous fluids may be required as per clinical need eg haemorrhage and need for and prescription of these fluids should be led by the obstetric team and are outside the scope of this guidance.
- In cases of fluid overload, hyponatraemia or pre-eclampsia consultant anesthetic, obstetric and pharmacy input required and ECU care.
- After the placenta is delivered the VRIII should be reduced to 50% of the rate which the infusion was running prior to delivery.

VRIII for use during labour (NICE recommended targets): Flash or CGM glucose levels should not be used for insulin dosing during VRII

	DOSING ALGORITHM *(Please see the guide below)*			
Algorithm →	1	2	3	4
Finger prick BG 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/h = mL/h)			
<4.0	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
4.0 – 5.5	0.2	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	

ALGORITHM GUIDE

- **ALL** women with diabetes should have Blood Glucose (BG) or intermittent or real time continuous glucose monitoring (CGM) testing hourly in established labour, after ARM or on admission for elective C-Section
- Start VRIII and Fluids if two consecutive BG/CGM > target (see below)

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 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)

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

Target BG level = 4.0 – 7.0 mmol/L

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

Move to the higher algorithm if the BG is above target and is not dropping

Move to the lower algorithm if BG falls below 4.0 mmol/L or is dropping too fast

9.2 Induction of labour

Current guidance for timing of IOL is – pre-existing diabetes 37-38+6 weeks and for gestational diabetes is 39-40+6 weeks

- Women with other maternal or fetal complications will have individualised care plans.
- Manage as per Induction of labour guideline, timing as per UHDB guidance Details for: Induction of Labour and Augmentation - Clinical Guideline › Trust Policies Procedures & Guidelines catalog (koha-ptfs.co.uk)

- Continue to eat and drink, monitor BG levels pre and post meal and take medication (insulin and/or metformin) as required until signs of labour.
- Once in established labour, monitor BG levels hourly.

9.3 Elective Caesarean Section

- Timing as in above full guidance
- Admit morning of procedure
- Prioritise women with diabetes as at risk of hypoglycaemia
- Women with gestational diabetes to take last dose of medication night before
- Women with pre-existing diabetes should be managed as per individualised plan on Lorenzo/V6, which should be documented by the diabetes team at the 36-week antenatal visit.

9.4 **Anaesthesia care**

If a woman has a general anaesthesia (GA) for birth, she should have her blood glucose monitored every 30-minutes from induction of GA, until after the birth and she is fully conscious.

10 Post delivery care

10.1 Gestational Diabetes

- Stop IV insulin (if started) as soon as placenta delivered.
- Before being transferred to community care, women should have their blood sugar tested pre and post-meal for 24-hours. This should be performed with the hospital glucose meter, not the patient's own they were provided with. Pre-meal should be <7mmol/L, post-meal <11.1mmol/L
- If blood glucose levels return to normal, offer:
  - After 12-weeks, offer a HbA1c blood test to exclude type II diabetes
  - Do not offer a 75g 2-hour GTT
- Referral will be made to the national diabetes prevention program

10.2 .Pre-Existing Diabetes

- Continue VRIII(if started) until the woman can eat and drink.
- Ensure that the long acting basal insulin has been given for ladies who are using multiple daily injections of insulin.
- Ensure that VRIII is continued until 1 hour after the first subcutaneous bolus of insulin is given and the woman has eaten.
- Follow individualised postnatal plan on maternity EPR
- Women with pre-existing type II diabetes who are breastfeeding, can resume or continue use of metformin immediately after birth. They should be advised to avoid other oral blood glucose-lowering medications whilst breastfeeding.
- Women with diabetes who are breastfeeding, should continue to avoid any diabetic medications stopped pre-conceptually/antenatally for safety reasons.

10.3 Women with Type 1 diabetes on insulin pumps

If there is any concern from staff or a patient that a woman is not able to safely manage their insulin pump due to anaesthetic/ analgesic effects or illness or exhaustion then the pump should be stopped and a VRIII commenced.

If she hasn't already done so, the woman must change the pump settings to her postnatal settings as described on her individual care plan provided by the diabetes team. If the woman's pump has been discontinued it should be **re-connected for one hour prior to discontinuing** the VRIII. Only discontinue VRIII when the woman can safely manage her own pump.

In the *absence* of a documented individual care plan, ensure the woman changes her pump following the advice below:

Basal rates should be reduced to 0.5 units per hour

Insulin to carbohydrate ratios should be changed to 1 unit of insulin per 15g of carbohydrate

Insulin sensitivity should be increased to 4.0 mmol/L

Glucose targets for continuous glucose monitoring should be increased to 3.9 – 10.0 mmol/L and women advised to aim for <1% TBR.

- The programed glucose target in the pump should be set to 8mmol/l
- Please note that an insulin bolus is usually not required for the first light meal taken post-delivery. The emphasis is now on avoidance of maternal hypoglycaemia so glucose targets are relaxed.
- • Refer to specialist diabetes pump team as soon as possible
- While on the ward, monitor pre- meal and pre bed finger prick capillary blood glucose, aiming for 8 – 10mmol/l (i.e. higher than pregnancy) to avoid hypoglycaemia.
- Diabetes team will review prior to discharge to ensure stable. The diabetes team should check pump settings and ensure that basal rates, insulin to carbohydrate ratios, insulin sensitivity factor and glucose target have been changed to post-natal settings.
- Women can be exhausted after delivery and may struggle to self-manage their diabetes. It is important to be vigilant of this. Check they have changed their insulin rates/ doses and are monitoring as above.
- Women with Type 1 diabetes will adjust their own insulin unless stated on the individualised plan. These women are at risk of hypoglycaemia, particularly if breast-feeding. These women should not be given side rooms, where hypoglycaemia could be unnoticed. Women should be encouraged to ensure that glucose is >6 mmol/l before starting to breast feed and before bed.

10.4 Women with Type 1 diabetes using Hybrid closed loop therapy

- Women using hybrid closed loop therapy (insulin pump and linked continuous glucose monitoring) will be given an individualised plan for labour and delivery and if necessary for steroids.
    - **Hybrid closed loop during labour and delivery**
- Most women will be able to continue their hybrid closed loop during labour and delivery and the algorithm should manage to keep the glucose levels in target.
- While in hospital women should continue to have pre and 1 hour post meal finger prick glucose readings aiming for the same targets as all other women with pre-existing diabetes.
- While in active labour finger prick blood glucose should be checked hourly. If one reading is above 7 then use of the boost function in the CAM APS app should be encouraged. If 2 further readings are >7 despite use of the boost function then VRIII should be started.
- Hybrid closed loop insulin delivery should be stopped if a woman is commenced on VRIII but the pump should be continued in manual mode with the programmed basal rate running at program B, the postnatal program.
- After delivery VRIII infusion rate should be reduced to 50% of the pre-delivery rate
- When ready to stop VRIII then the pump should be run as stand alone basal rate (not in HCL) for an hour while the VRIII is also running and after an hour the VRIII can be removed and the hybrid closed loop system restarted.
- When restarting hybrid closed loop post delivery or if HCL has been continued during delivery
    - Change personal glucose target to 8 mmol/l and advise woman to use ease off as required (CAM APS)
    - On medtronic 780g change smartguard target to 6.7 and advise patient to use temporary target for 7 days.
    - Change insulin to carbohydrate ratios to 1:12 (unless a personalised plan has already been made by the diabetes team)
    - Check body weight and update in app (CAM APS)- woman advised to keep doing this weekly.
    - Change to programmed basal rate B which will have been advised by the diabetes team. If there is no basal programmed in rate B, then use the following calculation: End of pregnancy Total daily dose of insulin/ 96 = units/hour basal .

11 Treatment of Hypoglycaemia

- Hypoglycaemia is a lower than normal blood glucose level, usually defined as a blood glucose level of below 4mmol/l and requires treatment if the woman uses insulin as a treatment for her diabetes. However, hypoglycaemia should be excluded in any person with

diabetes who is acutely unwell, drowsy, unconscious, unable to co-operate, or presenting with aggressive behaviour or seizures.

- Any patient with a blood glucose level less than 4 mmol/l, with or without symptoms, and who is conscious and able to swallow, should have 10–20 g of fast-acting carbohydrate (4–7 glucose tablets, 150–200 mL of pure fruit juice or 2 tubes of glucose 40% gel e.g. Glucogel®, Dextrogel®, or Rapilose gel®. Hypoglycaemia treatment is different for patients on hybrid closed loop as less carbohydrate is required. Women using hybrid closed loop therapy will have been given specific advice about management of hypoglycaemia according to their particular system, but as a general rule ,10g of fast acting carbohydrate should be given.
- Chocolates and biscuits should be avoided if possible, because they have lower sugar content and their high fat content may delay stomach emptying.
- Recheck blood glucose level after 10-15 mins, and repeat treatment if level remains below 4mmol/l, up to a maximum of 3 treatments in total.
- Hypoglycaemia which does not respond (blood glucose level remains below 4 mmol/l after 30–45 minutes or after 3 treatment cycles), should be treated with one of the following
- Intramuscular glucagon 1mg
- 200ml 10% IV glucose over 15 minutes
- 100ml of 20% IV glucose over 15 minutes.
- Once blood-glucose concentration is above 4 mmol/litre and the patient has recovered, a snack providing a long-acting carbohydrate should be given to prevent blood glucose from falling again (biscuits, sandwich) (Diabetes UK, 2013). A snack of long acting carbohydrate is NOT necessary for women using hybrid closed loop systems.

12 Contact Numbers

In the first instance, please inform the Diabetes Specialist Midwife of any inpatients requiring a review during normal working hours. Out of hours and weekends, please contact the oncall diabetes team at RDH via switch, or at QHB or if diabetes team unavailable, please contact oncall medical consultant/registrar

Role	**Number**
Consultant Diabetologist	Via Switch
Diabetes Specialist Nurse On call 8.30am-4.30pm	07384245434 RDH 07385375932
Consultant Obstetrician	Via Switch
Diabetes Specialist Midwife	RDH 07917650753

	QHB 07384914126
Weekend (diabetes team) Consultant and DSN (Sunday morning)	Via Switch

13 Monitoring Compliance and Effectiveness

Monitoring requirement	All health records of women who have pre-existing diabetes will be audited as per agreed audit forward programme

14 References

NICE Diabetes in Pregnancy: management from the pre-conception to the post natal period 2015 accessed via *http://www.nice.org.uk/guidance/ng3/resources/diabetes-in-pregnancy-management-of-diabetes-and-its-complications-from-preconception-to-the-postnatal-period-51038446021* [last accessed 17th November 2020]

Diabetes UK: The Hospital Management of Hypoglycaemia in Adults with Diabetes Mellitus 2013 accessed via https://diabetes-resources-production.s3-eu-west-1.amazonaws.com/diabetes-storage/migration/pdf/JBDS%2520hypoglycaemia%2520position%2520%282013%29.pdf [last accessed 17th November 2020]

JBDS_12_Managing_diabetes_and_hyperglycaemia_during_labour_and_birth_with_diabetes_April_2022_Archive.pdf (abcd.care)

BP-Pregnancy-DTN-V2.0.pdf (abcd.care)

Antenatal corticosteroids to reduce neonatal morbidity and mortality (Green-top Guideline No. 74) | RCOG

Variable Rate Insulin Infusion (Sliding Scale) FOR LABOUR/ DELIVERY

VRII for use during labour (NICE recommended targets): Flash or CGM glucose levels should not be used for insulin dosing during VRII

	DOSING ALGORITHM *(Please see the guide below)*			
Algorithm →	1	2	3	4
Finger prick BG 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/h = mL/h)			
<4.0	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
4.0 – 5.5	0.2	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	

ALGORITHM GUIDE

- **ALL** women with diabetes should have Blood Glucose (BG) or intermittent or real time continuous glucose monitoring (CGM) testing hourly in established labour, after ARM or on admission for elective C-Section
- Start VRIII and Fluids if two consecutive BG/CGM > target (see below)

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 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)

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

Target BG level = 4.0 – 7.0 mmol/L

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

Move to the higher algorithm if the BG is above target and is not dropping

Move to the lower algorithm if BG falls below 4.0 mmol/L or is dropping too fast

- **1st line ideal fluids:**
- 5% glucose & 0.9% sodium chloride with 0.15% KCL (10mmols potassium) 500ml bag @ 50mls / hr.
- **If unavailable substitute with the following fluids:**
- 4% glucose, 0.18% NaCL with 20mmols KCL(potassium per litre) @50ml/hr
- Insulin infusion: 50 units human soluble insulin in 50mls Sodium Chloride 0.9%
- Monitor blood glucose every hour, aim to keep glucose at 4-8mmol/litre

VRIIII for use during antenatal steroids

VRII for use during administration of steroids (NICE recommended targets): Flash or CGM glucose levels should not be used for insulin dosing during VRII

Algorithm →	1	2	3	4
Finger prick BG 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/h = mL/h)			
<4	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
4.0 – 5.5	0.2	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	

ALGORITHM GUIDE

- Start VRIII and Fluids if BG levels are > target on 2 consecutive readings and continue for up to 12 hours after the last dose
- **ALL** women with diabetes should have hourly blood glucose (BG) monitoring while on VRIII for the management of steroid hyperglycaemia during pregnancy

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 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)

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

Target BG level = 4.0 – 7.8 mmol/L

Check BG every hour whilst on VRIII

Move to the higher algorithm if the BG is above target and is not dropping

Move to the lower algorithm if BG falls below 4.0 mmol/L or is dropping too fast

1st line ideal fluids:
5% glucose & 0.9% sodium chloride with 0.15% KCL (10mmols potassium) 500ml bag@50ml/hr

If unavailable substitute with the following fluids:
4% glucose, 0.18% NaCL with 20mmols KCL(potassium per litre) @50ml/hr

- Insulin infusion: 50 units human soluble insulin in 50mls Sodium Chloride 0.9%
- Monitor blood glucose every hour, aim to keep glucose at 4-8mmol/litre

Usual basal insulin should be continued

Variable Rate Insulin Infusion for Women with Diabetes and Pre-Eclampsia

For use on LW/ ECUnly

For women with pre-eclampsia on intrapartum / postpartum fluid restriction the total delivered fluids, including oral and IV medication and fluids should be <80 ml/hr.

The IV fluids to run as substrate for the VRIII should be the same as in women without pre-eclampsia, but if needed the rate should be reduced, although the recommended rate of 50ml/hr should comfortably fit into the pre-eclampsia fluid restriction guidance.

Consider inserting a 10cm 18G Leadercath Cannula in an antecubital vein by the anaesthetist on call – use largest vein available if anaesthetist unavailable. If the woman has multiple infusions running a multi-lumen line may be preferable – please discuss with Consultant Obstetric anaesthetist.

Post GTT letter RDH site

What happens after your glucose tolerance test?

If the result of your GTT is normal:

A copy of the results stays in your hospital records; however you will not be contacted. Your community midwife may be able to access the records electronically if you request the result. If you have any concerns regarding the test results, please do not hesitate to contact Antenatal clinic.

If the result of your GTT is abnormal;

You will be contacted within a week of having your test. You will be invited to attend a group education session, run by the Diabetes Specialist Midwife and Dietician to learn how to manage your glucose levels during your pregnancy.

Group Education Session

This group session runs on a Tuesday morning from 10.00-1200 hours and takes place virtually on microsoft teams with a diabetes specialist midwife and a dietitian

Further appointments will be made for you in the diabetes antenatal clinic.

Post GTT letter QHB site

What happens after your glucose tolerance test?

The results of your GTT will be available in the next few days.

If the result of your GTT is normal:

A copy of the results stays in your hospital records; however you will not be contacted. Your community midwife may be able to access the records electronically if you request the result. If you have any concerns regarding the test results, please do not hesitate to contact the MAU or the diabetes specialist midwife on 07384914126, Monday to Friday 9-5.

If the result of your GTT is abnormal;

You will be contacted within a week of having your test. You will be invited to attend a group education session to learn how to manage your glucose levels during your pregnancy.

Group Education Session

This group session runs on a Tuesday morning from 10.00-1200 hours (occasionally this time may change due to staff holidays) and takes place virtually on microsoft teams with a diabetes specialist midwife and a dietitian

Further appointments will be made for you in the diabetes antenatal clinic.

Gestational Diabetes and your diet Patient Information Leaflet

Once you are diagnosed with gestational diabetes it is important that you check your blood glucose levels every day, for the remainder of your pregnancy.

You should test your blood glucose when you wake up and one hour after each main meal. The targets to aim for are less than 5.3mmol/L on waking and less than 7.8mmol/L one hour after your meals.

It is important to know:

- Which foods have an effect on your blood glucose level
- What you can do to manage this effect on your blood glucose level

Which foods have an effect on my blood glucose levels?

<table>
<tr><th colspan="3">Foods that <u>will raise</u> your blood glucose</th><th colspan="2">Foods that <u>won't raise</u> your blood glucose</th></tr>
<tr><td colspan="3">Carbohydrate foods</td><td colspan="2">Non-carbohydrate foods</td></tr>
<tr><td rowspan="2">Starchy foods</td><td colspan="2">Sugars</td><td>Proteins</td><td>Fats</td></tr>
<tr><td>Added</td><td>Natural</td><td></td><td></td></tr>
<tr><td>Bread
Rice
Pasta
Potatoes
Cereals
Chapattis
Pastry
Noodles
Flour
Pies/sausage rolls/pasties
Battered food
Pizza (base)
Takeaways
Fast food</td><td>Treats:
Cakes
Chocolate
Biscuits
Sweets
Ice cream
Custard/Jelly
Puddings

Sugary drinks:
Full sugar pop/squash
Fruit juice
Hot chocolate,</td><td>Fruit:
Dried
Fresh/frozen
Tinned

Dairy:
Milk
Yoghurt</td><td>Meat/poultry
Fish
Eggs
Pulses (e.g. beans)
Lentils
Quorn
Tofu
Nuts & seeds
Cheese</td><td>Butter
Cheese
Mayonnaise
Margarine
Oil

Eating large amounts of these foods can encourage weight gain</td></tr>
<tr><td colspan="3"></td><td colspan="2">Vegetables and Salad

Most vegetables and leafy salad won't have an effect on your blood glucose

Remember - Starchy vegetables will</td></tr>
</table>

	lattes, milk shakes, malt drinks		*raise* your blood glucose levels. These include potatoes, sweet potatoes, yam and plantain

Food and drink that contains **carbohydrate** is broken down in your stomach into glucose. This glucose moves across into your blood stream, causing your blood glucose level to rise.

Insulin is a hormone which lets the glucose in to your cells, so it can be used for energy. With gestational diabetes, your body struggles to produce enough insulin to do this which results in higher than normal blood glucose levels.

How will it affect my baby?

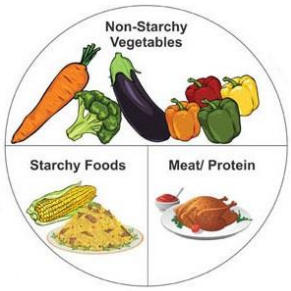
The more glucose there is in your blood, the more your baby will get. The extra glucose puts your baby at risk of growing too large, which may lead to a more difficult and earlier delivery for both you and your baby.

What can I do to help to manage this effect on my blood glucose levels?

It is important that you still include carbohydrate food in your diet, but it is better to spread your carbohydrates out evenly across the day and to choose slow-release carbohydrate options where possible.

Top tips:

1. Have smaller amounts of starchy carbohydrate foods with your meals. Fill the rest of your plate up with non-carbohydrate foods such as lean proteins and vegetables.



2. Choose *slow-release* starchy carbohydrate foods to help manage the effect on your blood glucose levels.

These include*: porridge, bran-flakes, granary/seeded/high protein bread, wholemeal chapatti, basmati rice, whole wheat pasta, sweet potato, new potatoes, pulses, beans, milk and plain yoghurt, certain fruit (e.g. apples/cherries/plums).* Remember these foods still affect your blood glucose level so you may need to reduce your portion to meet the target.

3. Try to eat some protein or have some healthy fat with your carbohydrate foods. This will slow down the rise in your blood glucose levels e.g. having cheese, peanut butter, avocado or eggs with your toast, meat with your potatoes etc.

Snacking

If you become hungry in between meals, you could include some low carbohydrate snacks in your diet. Try to wait until one hour after your last meal so that you can check your blood glucose level before you have your snack. (Please refer to the ‘carb free snacks’ diet sheet for more information)

SUGGESTED MEAL PLAN

Meal	Suggested meal plan
Breakfast	Porridge oats/Bran flakes with semi skimmed milk, or, Eggs/bacon/avocado on one slice of granary toast
Mid-morning	125g pot of yoghurt (containing less than 5g sugar per 100g)
Lunch	Chicken salad sandwich (on granary/high protein bread), and a handful of raspberries/sliced apple
Mid afternoon	Low carbohydrate snack, e.g., Small bag of plain popcorn or vegetable sticks with houmous or slices of cooked meat
Evening meal	Spaghetti bolognese (small portion of pasta) plus a side salad
Supper	Glass of milk and/or cheese and crackers

Being active

Being active after a meal can also help to manage your blood glucose levels. If you find your blood glucose levels are higher than 7.8mmol/L one hour after a meal, you could try going for a walk. This would help to use up some of the extra glucose in your blood from that meal.

Will changing my diet be enough?

For some ladies, changing their diet is not enough and they will need medication to help meet the glucose targets. This will either be a tablet called Metformin or Insulin injections.

It is important to continue with the healthy changes after pregnancy, as this will help to lower your risk of gestational diabetes in future pregnancies and reduce or delay the risk of Type 2 diabetes later in life.

Contacts

Diabetes specialist dietitian: 07880402114
Diabetes specialist nurse: 07766137252

Appendix G

Metformin Modified Release (MR) dose titration for gestational diabetes

Metformin MR 500mg has been prescribed to help control your blood sugar levels. To begin with you should take one tablet (500mg) once a day with your evening meal. It should be taken with food. This medicine is routinely used in pregnancy to control blood sugar levels.

If after 3 days your blood sugar level remains out of target, please increase to **2 tablets of** Metformin MR **500mg** with your evening meal and continue checking your blood sugar levels.
Out of target means either:

- Before breakfast your blood sugar level higher than or equal to **5.3mmol/l**
  OR
- 1 hour **a**fter food your blood sugar level is higher than or equal to **7.8mmol/l**

This can be increased by adding 1 tablet to your dose every 3 days until you are taking the maximum dose of 4 tablets of Metformin MR 500mg with your evening meal.
You can also split the dose to take with breakfast and evening meal if tablets are causing tummy problems. For example, if you need to take 3 tablets each day to control your blood sugar levels, take one with breakfast and two with your evening meal.

Please remember maximum dose is 2000mg (4 tablets) a day.

Please call the antenatal diabetes team if any concerns:
07984245441 (Mon-Thurs)
07766137252 (Tue- Fri)

Humulin and Novorapid

Humulin I/

Cloudy insulin to be taken-

Before breakfast ……Units
Before evening meal ……..Units
Before bed …….Units

- Use a new needle for each injection.
- Always mix the insulin as you have been shown, before use.
- Do a 2 unit test shot.
- Dial up required dose.
- Keep insulin in use at room temperature but store spare insulin in the fridge.
- Hypo = blood sugar below 4mmol/l
    - Treat with 5 glucose tables or a small carton of pure fruit juice or a small can of full sugar coke.
- If you drive – have you informed the DVLA and your insurance company?

Novorapid /

Clear insulin to be taken before meals-

Before breakfast ……Units
Before Lunch ……Units
Before evening meal ……..Units

- Use a new needle for each injection.
- Do a 2 unit test shot.
- Dial up required dose.
- Keep insulin in use at room temperature but store spare insulin in the fridge.
- Hypo = blood sugar below 4mmol/l.
    - Treat with 5 glucose tables or a small carton of pure fruit juice or a small can of full sugar coke.
- If you drive – have you informed the DVLA and your insurance company?

Documentation Control

Reference Number: UHDB/D1	**Version:** UHDB Version 1	**Status:** Final	

Royal Derby prior to merged document:			
Version	Date	Author	Reason
V5	Aug 2017	Dr P King – Consultant physician Dr E Wilmot Consultant physician Mrs K Dent, Consultant Obstetrician/CD S Wooley- Midwife (Diabetes)	Revised GDM pathway due to capacity issues
Burton Trust prior to merged document:			
V8	Jan2018	Dr W Oakley Consultant Obstetrician Dr Haleema Hayat Consultant Endocrinologist	3 yearly review
Version control for UHDB merged document:			
UHDB V1	Feb2021	Mrs K Dent, Consultant Obstetrician/CD Dr P King – Consultant physician L Bancroft - diabetes specialist midwife	Merge, assure NICE compliance
V1.1	Mar21	C Meijer	Amend on sliding scale appendix to allow operationally for different size syringe. No clinical practice change
V1.2	Feb 2023	Beverley Sellors - Diabetes Midwife	Amendment to Section 9.1 re when to start insulin in labour
1.3	October 2023	Mrs K Dent- Consultant obstetrician Dr Emma Robinson- Consultant Physician Leanne Bancroft - Diabetes Specialist Midwife	Update of variable rate. Update to include changes to glucose monitoring guidance and also Saving babies Lives Compliance.
1.3.1	Jan 2024	Diabetic team and Pharmacy	Amends to Sliding scale fluids
1.4	June 2024	Lauren Wilkinson - Risk Support Midwife	Amends to EPR system for implementation of BadgerNet
1.5	July 2024	Lauren Wilkinson - Risk Support Midwife	To ensure compliance with national guidance
1.6	October 2024	Lauren Wilkinson - Risk Support Midwife	Amendment to PN glucose testing, in-line with JBDS guidance
Intended Recipients:			
Changes in this version:			

• Update of VRII • Updated glucose monitoring guidance • SBL V3 compliance	
To be read in conjunction with: AN care, induction of labour, GTT in pregnancy, caesarean section	
Keywords: GDM, diabetes, GTT	
Consultation with:	Obstetricians – Anuja Joshi, Soniya Chaudhry, Mathangi Thangavelu Diabetologists – Emma Robinson, Emma Wilmot, Haleema Hayat, Christine Kotonya Diabetes Specialist Nurses – Nicola Pearson, Cathy Kedge Diabetes Specialist Midwives – Beverley Sellers, Amy Bailey Diabetes Specialist Dietician – Pash Dhindsa
Business Unit sign off:	24/11/2023: Maternity Guidelines Group: Miss A Joshi – Chair 02/09/2024: V1.5: Maternity Guidelines Group: Miss A Banerjee – Chair 04/12/2023: Maternity Governance Group/CD – Mr R Devaraj 09/09/2024: V1.5: Tier 4 Maternity Quality & Safety Assurance - Miss J Heslop
Divisional sign off: 19/12/2023 Notification Overview sent to TIER 3 Divisional Quality Governance Operations & Performance: V1.5: 17/09/2024	
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Key Contact:	Joanna Harrison-Engwell