Clinical Guideline

Health
Hunter New England
Local Health District

Maternity - Diabetes in Pregnancy, Labour, Birth & the Postnatal Period

Sites where Clinical Guideline applies	HNELHD for sections 1 – 5 & 9 **Sections 6 – 8 inclusive are for John Hunter Hospital**
This Clinical Guideline applies to:	
1. Adults	Yes
2. Children up to 16 years	Yes - Potential for all maternity care guidelines to apply to girls under 16 years.
3. Neonates – less than 29 days	No
Target audience	All maternity care providers: includes midwives, obstetricians and medical officers
Description	This clinical guideline identifies care concerns and makes recommendations for the management of pregnant, birthing and postnatal women with type 1 & 2 diabetes & gestational diabetes. **This guideline has been written for care of patients at John Hunter Hospital. Individual sites will need to determine the appropriateness of recommendations for their clinical circumstances.**

Go to Guideline

Keywords	Maternity, diabetes, labour, birth, postnatal, hypoglycaemia, hyperglycaemia, gestational, type 1, type 2, blood glucose level, BGL, insulin, PARU, pre-admission, perioperative, JHH, RNC
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Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:

- **See Reference Section on page 21 for Related Documents**

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GLOSSARY

Acronym or Term	Definition
ACR	albumin to creatinine ratio
ANC	Antenatal clinic
Basal insulin	Background long acting insulin. Common preparations include Protaphane, Lantus, Levemir, Humulin NPH
BGA	Blood group & antibodies
BGL	Blood glucose level
BMI	Body mass index
Bolus insulin	Rapid acting insulin, usually administered with a meal. Common preparations include: NovoRapid, Humalog, Apidra, Actrapid, Humulin R.
CNS	Central Nervous System
C/S	Caesarean section
CTG	Cardiotocography
DIP	Diabetes in pregnancy (includes gestational and pre-existing diabetes)
DKA	Diabetic ketoacidosis
EUC	electrolytes, urea, creatinine
ELUSCS	Elective lower uterine section caesarian section
FBC	full blood count
GCT	Glucose challenge test
GDM	Gestational diabetes mellitus
GP	General Practitioner
HAPO	Hyperglycemia and Adverse Pregnancy Outcome Trial
HbA1c	Glycated haemoglobin (A1c), which identifies average plasma glucose concentration.
HNE	Hunter New England
IADPSG/WHO	International Association of Diabetes and Pregnancy Study Groups/ World Health Organisation

Hypoglycaemia (hypo)	When a blood glucose is less than 3.8 mmol/L
LHD	Local Health District
IIMS	Incident Information Management System
IOL, IoL	induction of labour
IV	Intravenous
JHH	John Hunter Hospital
LFT	liver function test
NICU	Neonatal Intensive Care Unit
NIPT	Non Invasive Prenatal Test
NT	nuchal translucency
OGTT	Oral glucose tolerance test
SCII ("Insulin Pump")	Subcutaneous insulin infusion pump
SMOC	Standard Maternity Observation Chart
TSH	thyroid stimulating hormone
U/A	urinalysis
VE	Vaginal examination

GUIDELINE

While not requiring mandatory compliance, staff must have sound reasons for not implementing standards or practices set out within guidelines issued by HNE Health, or for measuring consistent variance in practice.

Risk Statement: This guideline has been developed to provide guidance to staff and to ensure that the risks of harm to patients and staff associated with the management of diabetes in pregnancy, labour, birth and the immediate postnatal period are identified and managed.

Sections 6–8 of this guideline have been written for management in a tertiary hospital. Individual sites should determine their own practices depending on resources available and write a local guideline reflecting this.

Any unplanned event resulting in, or with the potential for, injury, damage or other loss to patients, staff or visitors as a result of this procedure must be reported through the Incident Information Management System and managed in accordance with the Ministry of Health Policy Directive: Incident management PD2014_004. This would include unintended injury that results in disability, death or prolonged hospital stay.

Risk Category: *Clinical Care & Patient Safety*

Staff Preparation

It is mandatory for staff to follow relevant: "Five moments of hand hygiene", infection control, moving safely/safe manual handling, documentation practices and to use HAIDET for patient/carer communication: Hand hygiene Acknowledge, Introduce, Duration, Explanation, Thank you or closing comment.

This guideline does not replace the need for the application of clinical judgment in respect of each individual patient.

1. INTRODUCTION

Gestational diabetes affects 5–10% of pregnancies, and is associated with increased maternal risks of pre-eclampsia and operative delivery, and fetal risks of macrosomia, polyhydramnios and subsequent metabolic complications. Treatment of gestational diabetes can reduce the risk of developing some maternal (e.g. pre-eclampsia) and fetal (e.g. macrosomia) complications, as well as reduce the long term metabolic risks for the child.

Pregnancy in women with pre-existing diabetes is also associated with risks to the woman and the developing fetus. Miscarriage, pre-eclampsia and preterm births are more common in women with pre-existing diabetes. In addition, microvascular complications such as diabetic retinopathy and microalbuminuria can worsen rapidly during pregnancy. Women with pre-existing diabetes are at risk of developing DKA even with moderate hyperglycaemia (≥ 10 mmol/L). Stillbirth, congenital malformations, macrosomia, birth injury, perinatal mortality and postnatal adaptation problems are more common in babies born to women with pre-existing diabetes.

Throughout this document there are glucose target and trigger levels for action.

- Glycaemic targets vary according to whether women have pre-existing or gestational diabetes, in keeping with the current best evidence at the time of ratification.
- Glycaemic targets listed in this document are a guide for most women, and may be individualised for each woman in consultation with her specialists.

CAPILLARY GLUCOSE TARGETS FOR DIABETES IN PREGNANCY	
10mmol/L and greater	Critical hyperglyceamia
7mmol/L	2 hour post-meal upper target (pre-existing diabetes) Upper range target while on IV Insulin-Dextrose infusion
6.7mmol/L	2 hour post-meal upper target (gestational diabetes) Trigger to start IV Insulin-dextrose infusion (labour or betamethasone)
5.5mmol/L	Upper acceptable fasting target (pre-existing diabetes)
5.0mmol/L	Upper acceptable fasting target (gestational diabetes)
3.8mmol/L	Lower acceptable glucose range. Treat for hypoglycaemia below this level

2. PRE-EXISTING DIABETES – PRE-CONCEPTION MANAGEMENT

The importance of avoiding unplanned pregnancy should be an essential component of diabetes education from adolescence for all women with diabetes. Women with diabetes who are planning to become pregnant should be informed that establishing good glycaemic control before conception and continuing this throughout pregnancy will reduce the risk of miscarriage, congenital malformation, stillbirth and neonatal death. It is important to explain that risks can be reduced but not eliminated.

Women and their families should be offered information about how diabetes can affect pregnancy. Information should include:

- Role of diet, body weight and exercise
- The importance of controlling blood glucose optimally both prior to conception and during pregnancy to minimise risks to mother and fetus
- Risks of hyperglycaemia, hypoglycaemia and hypoglycaemia unawareness

- The effect of nausea and vomiting on glycaemic control
- The risks associated with a baby that is large for gestational age (LGA) and associated birth interventions – induction of labour and caesarean section
- The need for assessment of diabetic retinopathy before and during pregnancy
- The need for assessment of diabetic nephropathy before pregnancy
- The importance of blood pressure control before and during pregnancy
- The risk of worsening of renal function and progression to end-stage kidney disease in women with pre-existing renal impairment and proteinuria.
- The importance of glycaemic control during labour and birth and establishment of early breastfeeding to avoid neonatal hypoglycaemia
- The possibility of the baby needing admission to the nursery or NICU
- The risk of the baby developing diabetes and/or obesity in later life

Women with diabetes who are planning to become pregnant should be:

- **Referred to an endocrinologist for pre-pregnancy optimisation, on the basis that:**
    - Optimising glycaemic control before conception and in the first few weeks of pregnancy is of key importance. Suboptimal glycaemic control before pregnancy and in early pregnancy is associated with congenital malformations and miscarriage
    - Blood glucose targets, glucose monitoring, medicines for treating diabetes (including insulin regimens) and medicines for complications of diabetes will need to be reviewed before and during pregnancy
- Prescribed high-dose folic acid supplementation (5 mg daily), continued until 12 weeks gestation, to minimise risk of neural tube defects
- Informed of the extra time and effort needed to manage diabetes during pregnancy and that she will have frequent contact with healthcare professionals
- Advised that the risks associated with pregnancies complicated by diabetes increase with the duration of diabetes and with the level of blood glucose and HbA1c
- Offered individualised dietary advice
- Offered advice on how to optimise weight if BMI is above 27 kg/m^2, in line with Obesity: identification, assessment and management of overweight and obesity in children, young people and adults
- Advised to use metformin as an adjunct or alternative to insulin in the pre-conception period and during pregnancy if they have Type 2 diabetes. The likely benefits from improved blood glucose control outweigh theoretical potential for harm. All other oral blood glucose-lowering agents and GLP-1 analogues should be discontinued before pregnancy and insulin substituted
- Advised to cease statin, fibrate and agents used to treat neuropathy (e.g. gabapentin) prior to pregnancy. Antihypertensive therapy must be reviewed prior to conception. ACE inhibitor/angiotensin receptor blockers are contraindicated in pregnancy and alternative antihypertensive agents may be required (e.g. methyldopa, labetalol or calcium channel blockers). Obstetric specialist advice should be sought

Recommendations for glycaemic target levels pre-pregnancy:

- In general, women with pre-existing diabetes should be advised to aim for glycaemic targets as close to normoglycaemia as possible, without causing problematic hypoglycaemia. In most women, this will represent an HbA1c target between 42 and 53 mmol/mol (6–7%).
- Reassure women that any reduction in HbA1c level towards the target range of 42–53 mmol/mol (6–7%). is likely to reduce the risk of congenital malformations in the baby.

- Strongly advise women with diabetes whose HbA1c level is above 86 mmol/mol (10%) to defer pregnancy until glycaemic control is improved, on the basis of significant associated risks of conception with hyperglycaemia, namely fetal abnormalities and fetal loss.

3. PRE-EXISTING DIABETES – ROUTINE ANTENATAL CARE

Women with pre-existing diabetes who become pregnant should have an urgent referral by their GP to a High-Risk Pregnancy Clinic (with Endocrinologist input if available). High-risk clinics are available at Armidale, Tamworth, (Manning) Taree, Moree, Maitland and the John Hunter Hospital.

- Referral should be made immediately on confirmation of pregnancy to facilitate early specialist review to optimise glycaemic control in early pregnancy.
- Advise pregnant women who are treated with multiple daily insulin injections to test their fasting, pre-meal, 2-hour post-meal and bedtime blood glucose levels daily during pregnancy; consider overnight testing if warranted.
- Advise pregnant women with type 2 diabetes to test their fasting and 2-hour post-meal blood glucose levels daily during pregnancy if they are:
    - On diet and exercise therapy only, **OR**
    - Taking metformin monotherapy or a single dose of basal insulin.

Target blood glucose levels for women with pre-existing diabetes

Achieving glycaemic targets is more difficult in women with pre-existing diabetes when compared to women with GDM. These targets should be used as a guide, and should be individualised based on patient circumstances.

Fasting capillary glucose	**3.8–5.5 mmol/L**
2 hours after commencing a main meal	**3.8–7 mmol/L**

Women should be encouraged to achieve the best possible blood glucose control while maximising safety and avoiding hypoglycaemia.

Monitoring of HbA1c in women with pre-existing diabetes

- Measure HbA1c levels in all pregnant women with pre-existing diabetes at the booking appointment to inform the level of risk for the pregnancy.
- Measure HbA1c levels in the second and third trimesters of pregnancy for women with pre-existing diabetes to assess the level of risk for the pregnancy. This does not replace the need for daily self-monitoring of capillary glucose as above.
- Be aware that level of risk for the pregnancy for women with pre-existing diabetes increases with an HbA1c level above 48 mmol/mol (6.5%).

Continuous glucose monitoring

Consider continuous glucose monitoring for pregnant women on insulin therapy if they have:

- Problematic severe hypoglycaemia (with or without impaired awareness of hypoglycaemia) **or**
- Unstable blood glucose levels (to minimise variability) or to gain information about variability in blood glucose levels

Ensure that support is available for pregnant women who are using continuous glucose monitoring from a

member of the joint diabetes and antenatal care team with expertise in its use.

Ketone testing and diabetic ketoacidosis for women with pre-existing diabetes

Type 1 diabetes:

- Advise pregnant women with Type 1 diabetes of the availability of meters for personal capillary blood ketone testing
- Advise that testing for ketones (blood or urinary) should be performed in the event of hyperglycaemia (BGL ≥ 10 mmol/L) or intercurrent illness
    - Individualised education regarding self-management of hyperglycaemia and ketonaemia should be provided
    - Capillary ketones > 0.6 mmol/L, urinary ketones > 1+ or persistent hyperglycaemia > 10 mmol/L should prompt urgent clinical review
- Advise women that diabetic ketoacidosis (DKA) in pregnancy can develop at lower levels of hyperglycaemia than outside pregnancy and that vigilant monitoring as above is required.

Type 2 diabetes:

- Fasting urinary ketone monitoring may be appropriate for women with Type 2 diabetes to detect carbohydrate restriction
- Advise pregnant women with Type 2 diabetes to seek medical advice if they become hyperglycaemic [BGL ≥ 10 mmol/L] or unwell, where ketone testing should be performed promptly by clinical staff

Retinal assessment during pregnancy for women with pre-existing diabetes

- Advise all pregnant women with pre-existing diabetes to attend retinal assessment by an optometrist or ophthalmologist following their first antenatal clinic appointment (unless they have had a retinal assessment in the last 3 months) and again at 28 weeks. If any diabetic retinopathy is present at booking, perform an additional retinal assessment at 16–20 weeks
- Ensure that women who have pre-proliferative diabetic retinopathy or any form of referable retinopathy diagnosed during pregnancy have ophthalmological review as soon as diagnosed
- Diabetic retinopathy should not be considered a contraindication to vaginal birth

Renal assessment during pregnancy for women with pre-existing diabetes

- If renal assessment has not been undertaken in the preceding 3 months in women with pre-existing diabetes, arrange electrolytes, creatinine and spot urine albumin:creatinine ratio at the first contact in pregnancy
- Referral to a nephrologist should be considered if any of the following:
    - Serum creatinine is abnormal (100 micromol/litre or more) (eGFR is unreliable in pregnancy and should not be used)
    - Spot urine albumin:creatinine ratio is greater than 30 mg/mmol or total protein excretion exceeds 0.5 g/day
    - Progressively rising creatinine or urinary albumin or protein excretion
- Optimal blood pressure control is important and targets should be identified and treated to in consultation between Obstetrics and Nephrology
- Thromboprophylaxis should be considered for women with nephrotic range proteinuria above 2

g/day and serum albumin less than 20 g/L

Detecting congenital anomalies

First trimester

Offer all women combined first trimester screening at 11+0 to 13+6 weeks

- Diabetes does not increase the risk of chromosomal abnormalities, therefore NIPT or invasive testing is considered as per routine indications for the general obstetric population

Morphology scan

A tertiary-level morphology scan via MFM or satellite clinic is required (with consideration given for a formal fetal cardiac echocardiogram with a cardiologist) for:

- All women with Type 1 diabetes
- Any woman with a HbA1c > 7% in the periconception period (3 months prior to conception to post-conception)

All other women with diabetes in pregnancy should have a formal morphology scan including cardiac views at 20 weeks.

There is a 2 to 3 fold increase in risk of major malformations in infants of mothers with diabetes, particularly cardiovascular, CNS, face and extremity defects. There appears to be a dose-response effect corresponding to periconception and early pregnancy glucose control.

Monitoring fetal growth and wellbeing

- Offer pregnant women with Type 1 diabetes ultrasound monitoring of fetal growth, Dopplers and liquor volume every 4 weeks from 20 to 36 weeks at a tertiary scanning unit such as maternal fetal medicine or satellite clinic with a fetal maternal medicine specialist
- Offer pregnant women with Type 2 diabetes ultrasound monitoring of fetal growth, Dopplers and liquor volume every 4 weeks from 20 weeks to 36 weeks with any ultrasound provider
- Offer pregnant women with GDM ultrasound monitoring fetal, growth and liquor volume at 30 and 36 weeks, unless there is concern with any scan or the clinical condition requires more frequent monitoring
- Provide an individualised approach to monitoring fetal growth and wellbeing for women with diabetes and a risk of fetal growth restriction (macrovascular disease and/or nephropathy)

Organisation of antenatal care for women with pre-existing diabetes

Ensure antenatal care is provided:

- Within a joint Diabetes and Antenatal clinic for women with diabetes who are pregnant OR
- In conjunction with the high risk antenatal clinics available across the LHD OR
- In consultation with an obstetrician and endocrinologist as outlined in HNE Health Pathways.

Assessment of blood glucose control should generally occur every 2 weeks or as deemed clinically appropriate.

The pathway for women with Type 1 or 2 diabetes is contained in Appendix 5.

4. GESTATIONAL DIABETES – SCREENING AND DIAGNOSIS

Routine testing of all women with 75 g OGTT at 24–28 weeks

All women not known to have GDM or DIP should have a 75 g OGTT at 24–28 weeks gestation.

- All women should be tested as stratification by risk factors is unreliable
- The Glucose Challenge Test (GCT) lacks both sensitivity and specificity and is no longer part of the diagnostic algorithm
- There is no need for a 3-day high-carbohydrate diet before the OGTT; however women should not restrict carbohydrates from their diet

Early testing for GDM in women with risk factors

Women not known to have pre-existing diabetes but at high risk for GDM should be tested early in pregnancy.

Women are at high risk for GDM if:

One of the following is present:	*OR*	*Two of the following are present:*
• History of impaired glucose tolerance or gestational diabetes • Polycystic Ovary Syndrome (PCOS) • Previous unexplained stillbirth • Previous baby with macrosomia • Indigenous background • Cystic fibrosis • BMI > 35 kg/m^2 • Women on medication that may cause diabetes, e.g. steroids, antipsychotics, immunosuppressants		• Immediate family history of diabetes • Age > 35 years • BMI > 30 kg/m^2 • Non-Caucasian background • Poor obstetric history (e.g. recurrent miscarriage, malformations etc.)

High-risk women should be screened for GDM using a step-wise approach:

- Fasting plasma glucose should be arranged at the earliest opportunity, preferably with other blood tests for early pregnancy
    - If fasting glucose is ≥ 5.1 mmol/L, gestational or pre-existing diabetes is strongly suspected, and Endocrinology referral should be arranged. Check HbA1c
    - If fasting glucose is < 5.1 mmol/L, a 2 hour 75 g oral glucose tolerance test should be arranged as soon as practicable after first encounter
- If fasting glucose and OGTT are within normal limits, the OGTT should be repeated at 24–28 weeks

Diagnostic criteria for gestational diabetes

The diagnosis of gestational diabetes mellitus at any time during pregnancy should be based on any one of the following blood glucose values:

Fasting plasma glucose	**5.1 mmol/L** or greater
1 hour after 75 g oral glucose	**10.0 mmol/L** or greater
2 hours after 75 g oral glucose	**8.5 mmol/L** or greater

Note:

- Diabetes mellitus first diagnosed in pregnancy may not necessarily be confirmed as diabetes that persists in the postpartum period. Diabetes is more likely to be confirmed in the postpartum period

when the hyperglycaemia in pregnancy is diagnosed early and/or the degree of hyperglycaemia is marked

- In areas where the rate of undiagnosed Type 2 diabetes is thought to be high, or in remote areas where the performance of a 75 g OGTT may be logistically difficult, a measurement of HbA1c can be considered. A level of ≥ 48 mmol/l (6.5%) is diagnostic of diabetes outside pregnancy and very likely represents previous undiagnosed Type 2 diabetes. There is insufficient evidence to correlate lower levels of HbA1c with lesser degrees of glucose intolerance.
- The new recommended diagnostic criteria will increase the prevalence of hyperglycaemia in pregnancy. Using IADPSG/WHO criteria, a prospective study in Wollongong demonstrated an increase from 9.6% to 13.0%.[14] A post hoc analysis of the HAPO trial sites in Australia demonstrated a prevalence in Brisbane of 12.1% and in Newcastle of 13.6%.

5. GESTATIONAL DIABETES – ANTENATAL CARE

- All women with gestational diabetes should be referred promptly to a clinic or centre with experience in managing gestational diabetes
- A standard pathway of care for women with gestational diabetes is outlined in the Appendix 6

Suggested glycaemic treatment targets in GDM

Clinician judgement should guide practice in this area, both in the setting of overall glucose targets and the glucose thresholds which would lead to pharmacological treatment of individual women.

In general, the following glycaemic targets are recommended for women with **gestational** diabetes:

Fasting capillary glucose	**3.8–5.0 mmol/L**
2 hours after commencing a main meal	**3.8–6.7 mmol/L**

Note:

- It is not routine for women to measure a 1-hour post meal BGL unless instructed by a clinician. For most women, the 2-hour post meal target should be used.

Monitoring of HbA1c in women with gestational diabetes

- If GDM is diagnosed prior to 20 weeks, measure HbA1c at the time of diagnosis to identify those who may have pre-existing Type 2 diabetes.
    - An HbA1c > 48 mmol/mol (6.5%) is diagnostic of diabetes outside of pregnancy and strongly suggests pre-existing diabetes
- In women with GDM, HbA1c levels are not routinely used to assess a woman's blood glucose control in the second and third trimesters of pregnancy

Ketone testing in gestational diabetes

- Fasting urinary ketone monitoring is appropriate for women with GDM
    - Positive fasting urinary ketones suggests carbohydrate restriction and should prompt clinical review
    - Persistent and high urinary ketones (> 1+) should prompt capillary ketones testing and discussion with endocrinologist regarding the possibility of insulin deficiency and undiagnosed Type 1 diabetes

- Advise pregnant women with gestational diabetes to seek urgent medical advice if they become hyperglycaemic (BGL ≥ 10 mmol/L) or unwell
- Test urgently for ketones in urine or capillary blood if a pregnant woman with any form of diabetes presents with hyperglycaemia (BGL ≥ 10 mmol/L) or is unwell, to exclude diabetic ketoacidosis
- During pregnancy, admit immediately women who are suspected of having diabetic ketoacidosis for care in a high dependency area such as the birthing unit, where they can receive immediate medical and obstetric care

SECTIONS 6–8 HAVE BEEN WRITTEN FOR MANAGEMENT AT A TERTIARY HOSPITAL.

INDIVIDUAL SITES SHOULD DETERMINE THEIR OWN LOCAL PRACTICE & WRITE A GUIDELINE REFLECTING THIS.

***(Pregnancy Intravenous Insulin-Glucose Infusion Form should only be used in sites approved for its Use)**

6. UNSTABLE GLYCAEMIC CONTROL IN THE ANTENATAL PERIOD

Stable glycaemic control is important throughout pregnancy. Most women with DIP should achieve BGLs at target. BGLs outside target are an indication for clinical review and treatment escalation. Where glycaemic instability is contributed to by intercurrent illness or where intensive education, monitoring and stabilisation are required, women should be recommended hospital admission for stabilisation of diabetes at a centre experienced in the management of diabetes in pregnancy.

Women should be made aware of an increased risk of hypoglycaemia and decreased symptoms of hypoglycaemia (hypoglycaemia unawareness) during pregnancy. This includes information about prevention, recognition and treatment. Type 1 and 2 diabetic women should be provided with brochure/education available from a Diabetes Educator if required.

Diabetic ketoacidosis (DKA) can be accelerated in pregnancy and is associated with adverse maternal and fetal outcomes (including fetal death). Women with Type 1 and 2 diabetes should have DKA excluded by blood gas and ketone measurement if presenting as unwell and may need admission and may require high dependency care. They will require obstetric and endocrine review with a plan for management made. The most common precipitants for DKA are:

- Omission or inadequate dosing of insulin
- Infection (e.g. pneumonia, urinary tract infection, gastroenteritis, viral)
- Hyperemesis
- Medical/surgical intercurrent illness such as pancreatitis
- Steroid induced hyperglycaemia after administration for fetal lung maturation

Principles of management of antenatal unstable glycaemia (not in labour) (see Appendix 3)

- Women should be admitted to a ward familiar with the management of diabetes in pregnancy
    - The woman should be admitted under the Obstetric team, with consultation from Endocrine and other medical teams

- Women with suspected unstable diabetes require prompt obstetric, medical and midwifery assessment, with a comprehensive management plan instituted
- Initially, BGL should be measured 30-minutely until stable and at target, thereafter hourly BGL may be sufficient
- CTG should be applied (≥ 25 weeks gestation) if BGL ≥ 10 mmol/L
- A medical officer must be informed and review the woman promptly. In the first instance, the obstetric registrar should be notified to review. Once this review has occurred, the obstetric registrar will liaise with the endocrine registrar or consultant, unless other arrangements have been made with midwifery staff. If there is a delay in the initial review, a senior obstetric registrar or consultant obstetrician should be contacted to escalate review as this is a serious maternity clinical issue that can be harmful to mother and baby
- Women with BGL ≥ 10 mmol/L must have an assessment for ketones in urine or blood
    - If ketones are present (urine > 1+, capillary > 0.6 mmol/L), urgent venous blood gas to assess for ketoacidosis must be performed and discussed with the Obstetrician and Endocrinologist
- Unstable BGL not responding to treatment or suspected DKA should be managed in a high dependency area such as the Birthing Unit
- Intravenous insulin infusion with concurrent intravenous glucose may be required for initial control as per Pregnancy Insulin/Glucose Infusion Form*(If Approved for use at your site). Endocrine consultation is advised.

Subcutaneous insulin infusion pump (SCII) use during admission for unstable glycaemic control (not labour)

- Continued inpatient use of SCII for a pregnant woman with unstable blood glucose requires clinician judgement based on individual patient circumstances. Factors to be considered include:
    - Medical comorbidities and reason for admission
    - Patient capacity for patient-controlled management of SCII pump functions, including whether or not this capacity is impacted by intercurrent illness
    - Familiarity of medical and midwifery staff with insulin pump therapy
    - In some circumstances it may be safer to remove the subcutaneous insulin pump and manage a patient on an intravenous insulin-glucose infusion alone until stable
- Early discussion with Endocrinologist is required to formulate an individual management plan in **all** circumstances
- A SCII pump should **never** be removed until appropriate alternate insulin therapy has been given, either with the establishment of an intravenous insulin infusion or administration of appropriate subcutaneous insulin
- Medical officers remain responsible for documenting admission SCII pump settings in the medical record and documenting advice to patient and any subsequent setting changes
- Midwifery staff remain responsible for monitoring and documentation of BGLs in accordance with this guideline, documenting patient self-care behaviours whilst on pump therapy and escalating to Medical Officers any concerns with patient's self-management

7. ANTENATAL BETAMETHASONE IN WOMEN WITH DIABETES IN PREGNANCY

General comments:

- Use of steroids is not contraindicated in women with DIP, although use significantly increases risk of maternal hyperglycaemia and postnatal fetal hypoglycaemia, and may possibly contribute to fetal acidosis
- Women with DIP who are receiving antenatal betamethasone should be admitted to hospital for glycaemic monitoring and management
- Both tocolysis and nifedipine may be used if clinically indicated

Administration of antenatal betamethasone (See Appendix 2)

The decision to administer betamethasone is made by the Obstetric Registrar or Consultant.

- Where possible, betamethasone should be administered between 6 and 9 am unless clinically more urgent
    - If betamethasone administration is planned to be given at another time for logistical reasons (e.g. bed management) rather than clinical urgency, glycaemic management should be discussed with an Endocrinologist prior to administration
- The betamethasone prescriber must also prescribe (in consultation with Endocrinology if concerns):
    - Patient's regular diabetic pharmacotherapy:
        - Pre-existing metformin therapy should be continued if no contraindication. Consideration should be given to withholding metformin in the setting of intercurrent illness, volume depletion or renal/hepatic impairment
        - It is usually appropriate to continue subcutaneous insulin concurrently with intravenous insulin in a stable antenatal patient
            - Pre-existing subcutaneous basal insulin therapy should be continued at pre-admission doses
            - Pre-existing mealtime insulin should be withheld if the patient is fasting
    - An anticipatory order for intravenous insulin and intravenous glucose, in accordance with the Pregnancy Insulin/Glucose Infusion Form*(If Approved for use at your site), to be commenced if any BGL reading is greater than 6.7 mmol/L in the 48 hours after betamethasone

All women with DIP and betamethasone must:

- Be managed on a Maternity Ward with experience in the management of unstable diabetes
- Have an Endocrine consult, preferably prior to betamethasone prescription, or within 8 hours. During business hours, this is the Endocrine Registrar. After hours, the Obstetric Registrar should contact the on-call Endocrinologist if clarification is required about the appropriate procedure

Monitoring whilst <u>not</u> on insulin infusion

- **All** women must have 2-hourly **capillary** BGL readings for 48 hours after first dose of betamethasone (during waking hours this should correspond to pre-meal and 2 hours post meals)
- Target BGL is 3.8–6.7 mmol/L

- The Medical Officer must be informed of:
  - Any BGL ≥ 10 mmol/L
  - Any reading below 3.8 mmol/L
- Pregnancy Intravenous Insulin/Glucose Infusion*(If Approved for use at your site) should be commenced if ANY reading is above 6.7 mmol/L (see below) **– note this is NOT** the "Standard Adult Intravenous Insulin Infusion"

Commencement of intravenous insulin with intravenous glucose

- Commence intravenous insulin and glucose immediately if any BGL is greater than 6.7 mmol/L
  - Insulin and glucose infusion should be prescribed on the Pregnancy Insulin/Glucose Infusion Form*(If Approved for use at your site), which contains detailed instructions about monitoring and rate variation (see Appendix 1). The 'Standard Adult Intravenous Insulin Infusion' should not be used
  - Intravenous glucose with premixed potassium (usually glucose 4% + sodium chloride 0.18% + 30 mmol/L potassium chloride) should be commenced at 80 mL/h in non-fasting women and 125 mL/h in fasting women. Clinicians should use judgement in individual circumstances (e.g. renal impairment, pre-eclampsia, electrolyte disturbance)
- Insulin infusion **RATE** (units/h) is adjusted **each hour** based on **hourly** capillary BGL measurements
- Insulin infusion **PROTOCOL** (A–E) should be:
  - Increased if BGL > 7 mmol/L for THREE CONSECUTIVE readings (for example, increased from Protocol B to Protocol C)
  - Decreased if ANY BGL < 3.8 mmol/L (for example, decreased from Protocol B to Protocol A)
- Medical Officer must be informed of any BGL < 3.8 mmol/L or any BGL ≥ 10 mmol/L
- Once commenced, the insulin-glucose infusion is routinely continued for 48 hours after first dose of betamethasone, after which time it can usually be ceased
- Management should be individualised by Endocrine consultation as early as practicable and escalated immediately if clinical concern

8. BIRTH

Timing of Birth

Type of diabetes	*Routine timing of birth*
Type 1 diabetes	**37–39 weeks**
Type 2 diabetes	**38–39 weeks**
GDM, treated with insulin/metformin	**39 weeks**
GDM, treated with diet alone	**40–41 weeks**

Spontaneous labour or induction of labour

Diet and subcutaneous insulin

- Mealtime insulin
    - Women may eat breakfast as usual and administer any prescribed mealtime insulin
- Basal insulin
    - Women should have usual long acting (basal) insulin, even if fasting. Check with Medical Officer if any concerns prior to administration
    - For patients with Type 1 diabetes, basal insulin must NOT be withheld
- **Insulin pump (continuous subcutaneous insulin infusion) in labour**
    - Specific advice **must** be sought from the treating Endocrinologist (this should occur antenatally and be documented in the antenatal record)
    - Once the woman is contracting or labour has commenced, the woman should be in the Birthing Unit & an intravenous insulin/glucose infusion should be commenced
    - The subcutaneous insulin-pump may remain attached to the patient (in addition to an intravenous insulin/glucose infusion) at the discretion of the treating Endocrinologist, providing that:
        - The subcutaneous basal rate is reduced according to a pre-partum plan or alternatively 50% of the late pregnancy rate
        - Subcutaneous bolus insulin is **only** administered through the pump to correspond with food intake
        - Correction boluses (not with food) are **not** to be administered via the subcutaneous pump
        - The woman demonstrates capacity for ongoing independent self-management of the pump
    - **If any of the above conditions are not met**, the subcutaneous insulin pump should be removed 30 minutes after the initiation of intravenous insulin-glucose
- Withhold metformin

Monitoring

- Complete admission
- For continuous CTG monitoring unless
    - Diet-controlled diabetes in spontaneous labour with no infusions OR
    - Other arrangement made in discussion with Obstetrician
- Blood glucose level (BGL) on admission, then hourly if not on IV insulin/glucose
    - Target BGL whilst not on IV insulin/glucose: 3.8–6.7 mmol/L
- Notify Obstetric Registrar and Neonatal Intensive Care (NICU)
- IV access 16 or 18G cannula (unless diet controlled diabetes in spontaneous labour with no infusions)
- Measure every urine specimen for ketones or at a minimum four hourly or blood for ketones every four hours

Treatment

- If BGL < 3.8 mmol/L, commence glucose 4% + sodium chloride 0.18% + 30 mmol/L potassium chloride premixed 1000 mL bag at 125 mL/h
- If BGL > 6.7 mmol/L, commence insulin and glucose infusions as per Pregnancy Insulin/Glucose Infusion Protocol*(If Approved for use at your site)
- Once insulin and/or glucose infusion commenced, BGL is to be monitored every 30 minutes with a target BGL of between 3.8 and 7 mmol/L. Refer to Pregnancy Intravenous Insulin/Glucose Infusion Form*(If Approved for use at your site) (Appendix 1) for changes to infusion
- Medical Officer must be notified of:
    - Any reading less than 3.8 mmol/L, OR
    - 3 consecutive readings > 7 mmol/L, OR
    - Any reading ≥ 10 mmol/L OR
    - If urinary ketones 1+ or greater or capillary ketones > 0.6 mmol/L
- Every 12 hours check venous blood potassium
- Notify Medical Officer if potassium is out of range

Elective caesarean section

Insulin-treated patients – Type 1 diabetes and Type 2 diabetes/GDM treated with insulin

- Continue long-acting and short-acting insulin or premixed insulin as usual the day before surgery
- If a long-acting insulin or premixed insulin is administered in the morning, advise patient to administer 50% of usual pregnancy dose on the day of surgery
- Do not administer short-acting insulin once patient is fasting
- For admitted patients with Type 1 diabetes, an insulin/glucose infusion should be commenced from time of fasting until post-partum
    - If the patient is treated with a subcutaneous insulin pump (SCII), this should be removed 30 minutes after an insulin/glucose infusion has been commenced
- For women on metformin therapy, this should be withheld on day of surgery
- Nil by mouth – see local procedure JHH_JHCH_BH_0057 Fasting prior to anaesthesia/sedation
- Admission should occur on the day of surgery if well controlled, otherwise the evening before surgery

Non-insulin treated patients (gestational diabetes, Type 2 diabetes on metformin monotherapy)

- Nil by mouth – see local procedure JHH_JHCH_BH_0057 Fasting prior to anaesthesia/sedation
- For women on metformin therapy, this should be withheld on day of surgery

For all patients:

- Conduct hourly BGL measurements whilst within target BGL of 3.8–6.7 mmol/L
- If BGL < 3.8 mmol/L, commence glucose 4% + sodium chloride 0.18% + 30 mmol/L potassium chloride premixed 1000 mL solution at 125 mL/h
- If BGL > 6.7 mmol/L, commence insulin and glucose infusions as per Pregnancy Intravenous Insulin Glucose Infusion Form*(If Approved for use at your site) (Appendix 1)
- Once insulin and/or glucose infusion commenced, BGL is to be monitored at least every 60 minutes with a target BGL of 3.8–7 mmol/L. Refer to Pregnancy Intravenous Insulin Glucose Infusion Form*(If

Approved for use at your site) for changes to infusion

- Change calling criteria for review on SMOC chart to be:
    - Any reading < 3.8 mmol/L
    - Any reading ≥ 10 mmol/L
- Measure every urine specimen for ketones or at a minimum four hourly or monitor blood for ketones every four hours

9. POSTNATAL

Type 1 diabetes:

All women with Type 1 diabetes should have an individualised postnatal plan documented in their medical record during the final weeks of their antenatal care to guide post-partum glycaemic management adjusted by regular consultation with the Endocrine team.

In the absence of a prior documented plan, the following can be used as a guide:

- Post-partum, reduce Pregnancy Intravenous Insulin/Glucose Infusion to Protocol A *(If Approved for use at your site) unless otherwise advised
- Continue insulin and glucose infusions until diet is re-established AND 2 hours have elapsed since a dose of subcutaneous insulin (long acting AND mealtime insulin OR subcutaneous insulin infusion pump)
    - Subcutaneous insulin should be recommenced at a reduced dose compared to those used in late pregnancy (guide: 50% reduction), but similar to the patient's pre-pregnancy regimen
- BGL targets in the post-partum period of 5–10 mmol/L are appropriate
    - If BGL above 10 mmol/L on two consecutive occasions, notify Medical Officer, either obstetric or endocrine (or out of hours medical)
    - Alter calling criteria on SMOC chart to be < 4 mmol/L and > 10 mmol/L postnatally on 2 consecutive occasions
- Review by Endocrine Team (or medical team if out of hours) on same day
- Measure urine for ketones fourth hourly at a minimum
- See : Intrapartum and Postnatal Flowchart for all diabetes in pregnancy (Appendix 4)

Type 2 diabetes:

Women with Type 2 diabetes should have a post-partum glycaemic management plan documented in their antenatal record.

In the absence of a prior documented plan, the following can be used as a guide:

- Post-partum, reduce Pregnancy Intravenous Insulin Infusion to Protocol A *(If Approved for use at your site) unless otherwise advised
    - Continue insulin and glucose infusions until diet and appropriate regular diabetic management is re-established
        - If treated with insulin prior to pregnancy, revert to the pre-pregnancy dosing regimen if known, or reduce the late pregnancy dosing regimen by at least 50%
        - If not treated with insulin prior to pregnancy, **do not** recommence subcutaneous insulin therapy postnatally unless advised by medical team
        - **Do not** restart oral hypoglycaemic agents unless instructed by medical team
    - Cease intravenous insulin infusion 2 hours after a meal
- BGL targets in the post-partum period of 5–10 mmol/L are appropriate

- If BGL above 10 mmol/L on two consecutive occasions, notify Medical Officer, either obstetric or endocrine (or out of hours medical)
- Alter calling criteria on SMOC chart to be < 4 mmol/L and > 10 mmol/L postnatally on 2 consecutive occasions

- Diet as tolerated
- Review by Endocrine team (or medical team if out of hours)
- See postnatal flow sheet

Note. Small amounts of metformin are secreted into breast milk, but adverse effects have not been observed in breastfed infants. Therefore, metformin is considered safe to use during breastfeeding.

Gestational diabetes:

- If treated with insulin/glucose infusion, both can be ceased after birth. Monitor BGL one hour after ceasing the infusion. Contact Medical Officer if BGL < 4 mmol/L or >10 mmol/L
- Routine monitoring of BGLs should occur twice daily for 48 hours post birth then should cease. Contact Medical Officer if BGL < 4 mmol/L or >10 mmol/L
- Advise women to attend for post-natal OGTT 6 weeks post-partum and to follow up this result with their General Practitioner
- See Intrapartum and Postnatal Flowchart.(Appendix 4)

FOR BABY:

- Please refer to Neonatal BGL chart

IMPLEMENTATION PLAN

1. Notification to LHD Midwifery managers, educators, medical officers of the guideline release.
2. In-service sessions for maternity & medical staff about the guideline & its use in the clinical areas across HNELHD, including use of the new Pregnancy Insulin-Infusion Protocol.
3. Notification of Clerical Staff regarding need to change over ward stationary to reflect new Pregnancy Insulin Infusion Protocol.
4. Notification of Endocrinology medical staff of the release of the guideline & adherence to the guideline.

MONITORING AND AUDITING PLAN

The effectiveness of the Pregnancy Adult Intravenous Insulin Infusion will be audited twice within the first 12 months. A safety audit will be performed after 50 cases, and an efficacy audit will be performed after 12 months and presented to the Diabetes Clinical Stream.

CONSULTATION WITH KEY STAKEHOLDERS

- Dr Henry Murray (WHAM Coordinator)
- Dr Andrew Woods (Director or Obstetrics JHH)
- Dr Shamasunder Acharya (Director of Diabetes, JHH)
- Dr Judy Luu (Clinical Lead, HNELHD Diabetes Stream)
- Dr Felicity Park (Director MFMU JHH)
- Dr Katie Wynne (Endocrinologist, JHH)
- Dr Eswari Vilayur (Nephrologist, JHH)
- Dr Chris Rowe (Endocrine Fellow JHH)
- Jacqueline Allabyrne (CMC High Risk Pregnancies, JHH)
- Alison Gebuehr (Diabetes Educator, JHH)
- Dr Rob Marr (Anaesthetics, JHH)
- Dr Tom Walker (Anaesthetics, JHH)
- Alison Fullbrook(NUM, Operating Theatres)
- Susan Johnson (NUM, Intervention Suite JHH)
- Managers & Obstetricians at Tamworth, Manning, Maitland & Armidale Hospitals

APPENDICES

1. Pregnancy Intravenous Insulin-Glucose Infusion Form_HNEMR268
2. Glycaemic Management following antenatal betamethasone
3. Flowchart for Inpatient Management of Unstable Diabetes Mellitus in Pregnancy
4. Intrapartum and Postnatal Flowchart for all diabetes in pregnancy
5. Pre-existing Diabetes: Standard Pathway for Antenatal Care
6. Gestational Diabetes: Standard Pathway for Antenatal Care
7. Clinical Audit

REFERENCES

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JHH_BH_0019: Maternity: Management of Antenatal Unstable Diabetes and Diabetes in Labour, Birth and Immediate Postnatal Period : 2013

Women and Newborn Health Service King Edward Memorial Hospital. Diabetic Ketoacidosis (DKA) Management Clinical Guideline June 2015

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Useful Links

GDM Health Pathway

Pregnancyanddiabetes.com.au NDSS website. Booklets also available in ANC for women with Type 1 or Type 2 diabetes who are planning a pregnancy

Related Documents

- NSW Health PD2013_043 Medication Handling in NSW Public Health Facilities
- NSW Health Policy Directive PD2017_032 Clinical Procedure Safety
- NSW Health Policy PD 2005_406 Consent to Medical Treatment – Patient Information
- NSW Health Policy Directive PD2017_013 Infection Prevention and Control Policy
- NSW Health Policy Directive PD2011_015 Care Coordination: Planning from Admission to Transfer of Care in NSW Public Hospitals
- NSW Health Policy Directive PD2009_060 Clinical Handover – standard key principles
- HNELHD Policy Compliance Procedure PD2009_060: PCP1 Clinical handover - ISBAR
- HNELHD CG 16_09 Maternity - Prevention of Venous Thromboembolism (VTE) in Pregnancy and the Puerperium
- HNELHD CP 16_13 Blood glucose AND Blood Ketone Monitoring with the Abbott Freestyle Optium Neo H Device
- HNELHD CG 16_45 Maternity – Obesity Management in Pregnancy, Labour, Birth and Postnatal Care
- NSW Health Policy PD2014_007 Pressure Injury Prevention and Management
- HNELHD Policy Compliance Procedure PD2014_007: PCP1 Pressure Injuries: Prediction, Prevention and Management
- HNELHD_CG 13_03 Hypoglycaemia

FEEDBACK

Any feedback on this document should be sent to the Contact Officer listed on the front page.

APPENDIX 1: Pregnancy Intravenous Insulin-Glucose Infusion Form HNEMR268 (Only for use at approved sites)

HUNTER NEW ENGLAND LOCAL HEALTH DISTRICT

Facility: _____

PREGNANCY INTRAVENOUS INSULIN – GLUCOSE INFUSION FORM

Attach ADR Sticker

HNE025905

FAMILY NAME	MRN
GIVEN NAME	☐ MALE ☐ FEMALE
D.O.B. ____ / ____ / ____	M.O.
ADDRESS	
LOCATION / WARD	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

HNEMR268

ALLERGIES & ADVERSE REACTIONS (ADR)
☐ Nil known ☐ Unknown (tick appropriate box or complete details below)

Drug (or other)	Reaction/Type/Date	Initials

Sign: ..... Print: ..... Date: .....

HOSPITAL/ WARD: _____

1ST PRESCRIBER TO PRINT PATIENT NAME & CHECK LABEL CORRECT: _____

See Medication Chart for details

IV INSULIN PROTOCOLS (Do **NOT** circle – prescribe changes in Section 2)

Note each *PROTOCOL* has a variable *RATE* of infusion adjusted based on capillary BGL measurements every 30-60 minutes

PROTOCOL to be adjusted if BGL readings remain outside target range despite changes in RATE (based on monitoring overleaf #)

Blood Glucose (BGL, mmol/L)	PROTOCOL A	PROTOCOL B	PROTOCOL C	PROTOCOL D	PROTOCOL E
	All intravenous insulin infusion rates in mL/hour (= units/hour)				INFUSION RATE
<3.8	Pause IV insulin. Give 15 g glucose. Repeat BGL 15 mins. Call Medical Officer for advice.				
3.8 – 4.9	0.2	0.5	0.8	1	_____
5.0 – 5.9	0.3	0.7	1	1.5	_____
6.0 – 6.9	0.5	1	2	3	_____
7.0 – 7.9	1	1.5	3	4	_____
8.0 – 8.9	1.5	2	4	6	_____
9.0 – 9.9	2	3	5	8	_____
≥ 10	3	4	6	10	_____
	Apply CTG ≥ 25 wk. Check IV Infusion Line. Check capillary ketones <0.6mol/l. Call Medical Officer for advice.				

1. INSULIN INFUSION STARTING PRESCRIPTION - MEDICAL OFFICER TO COMPLETE

Date	Time	Insulin Type	Route	Starting Protocol*	MO Sign/Print
			IV		

☐ Commence automatically with BGL > 6.7 mmol/L. OR ☐ Midwife to contact MO before commencement

☐ Midwife to vary Protocol (A-E) as per monitoring#. OR ☐ Midwife to contact MO to adjust Protocol

* Suggested Starting Protocol: Most women should commence Protocol B. Women with high insulin requirements (> 100 units/day) may commence Protocol C. Insulin sensitive women may require Protocol A

* Suggested IV Fluids: Glucose 4% + sodium chloride 0.18% + 30 mmol/L potassium chloride. Antenatal: 80 mL/hr. Labour/NBM: 125 mL/hr

* Concurrent subcutaneous insulin: Continue subcut basal insulin in all women. Withhold subcut bolus insulin with meals if fasting

2. INSULIN INFUSION PROTOCOL ADJUSTMENT - DOCUMENT ALL CHANGES TO PROTOCOL (A–E)

Date	Time	New Protocol	MO Sign/Print (if contacted)	Midwife/RN 1 Sign/Print	Midwife/RN 2 Sign/Print

3. IV FLUID PRESCRIPTION - MEDICAL OFFICER AND MIDWIFE TO COMPLETE

Date	Fluid	Route	Rate (mL/hr)	MO Sign/Print	Midwife/ RN 1 Sign	Midwife/ RN 2 Sign	Time Commenced
		IV					
		IV					
		IV					

4. RECORD OF SYRINGE PREPARATION – MIDWIFE TO COMPLETE

Syringe No.	Date	Time	Insulin Concentration ALL PROTOCOLS: 50 units short acting insulin made up to 50 mL total volume with sodium chloride 0.9% (final concentration is 1unit in 1mL)	Midwife/ RN 1 Sign	Midwife/ RN 2 Sign
			50 units of _____ insulin in 50 mL sodium chloride 0.9% for injection		
			50 units of _____ insulin in 50 mL sodium chloride 0.9% for injection		
			50 units of _____ insulin in 50 mL sodium chloride 0.9% for injection		

300917

Page 1 of 2

BINDING MARGIN – DO NOT WRITE

PREGNANCY INTRAVENOUS INSULIN – GLUCOSE INFUSION FORM

Medication

HUNTER NEW ENGLAND LOCAL HEALTH DISTRICT

Facility: ______________________________

HNE025905

PREGNANCY INTRAVENOUS INSULIN – GLUCOSE INFUSION FORM

FAMILY NAME	MRN
GIVEN NAME	☐ MALE ☐ FEMALE
D.O.B. ____ / ____ / ____	M.O.
ADDRESS	
LOCATION / WARD	
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE	

HOSPITAL/ WARD: ______________________________

1ST PRESCRIBER TO PRINT PATIENT NAME & CHECK LABEL CORRECT: ______________________________

See Medication Chart for Details

Date	Time	Protocol (A–E)	BGL (mmol/L)	Rate (mL/hr)	mL remaining in syringe	Midwife/RN Initial	Comment

Obtain new recording sheet and prescription every 24 hours

MONITORING AND ADJUSTMENT#.

While on infusion BGL is monitored every 30 minutes in labour or when outside target, or hourly otherwise.

BGL	Action
Less than 3.8 mmol/L	1. Pause IV insulin. Give 150 mL Lucozade (or 150 mL glucose 10% if NBM). 2. Inform Medical Officer. 3. Repeat BGL in 15 minutes. Repeat Step 1 if BGL remains less than 3.8mmol/L. 4. When BGL above 3.8 mmol/L for 2 readings 15 minutes apart, restart IV insulin at REDUCED Protocol (e.g. C → B)
3.8–7 mmol/L	At target. No change to Protocol. Adjust infusion rate based on 30-60 minutely BGLs.
Above 7 mmol/L	Above target. Adjust rate. Repeat BGL in 30 minutes.
Above 7 mmol/L for 3 consecutive readings	Above target. 1. Check infusion line. 2. Increase **Protocol** (e.g. B → C or C → D). 3. Repeat 30 minutely checking and adjust **rate** as required
Any reading 10mmol/L or higher	1. Repeat immediately to confirm. 2. Check infusion line. 3. Consider increasing Protocol (e.g.. B → C) 4. Apply CTG. 5. Check capillary ketones <0.6mmol/L. 6. Call Medical Officer for advice.

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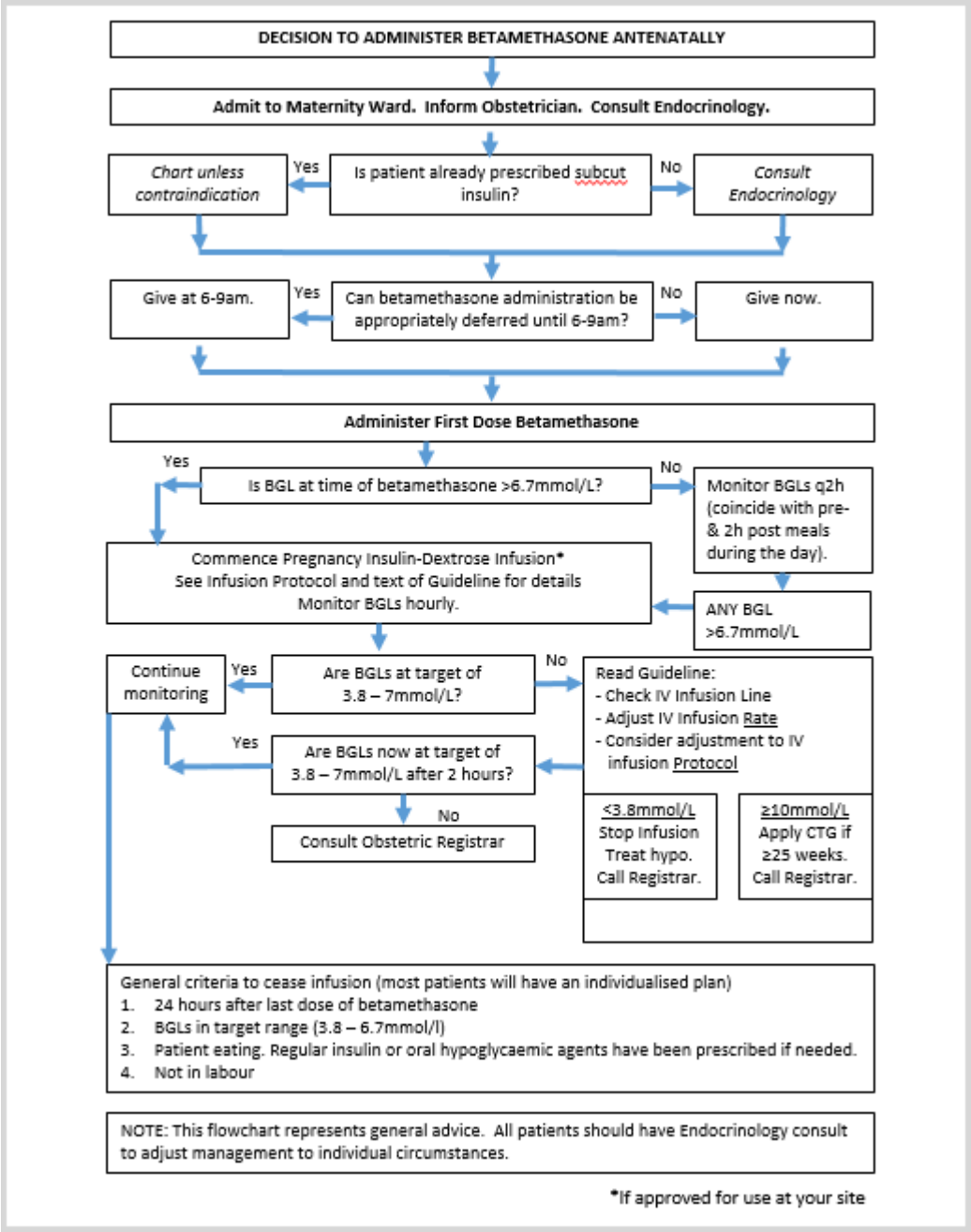
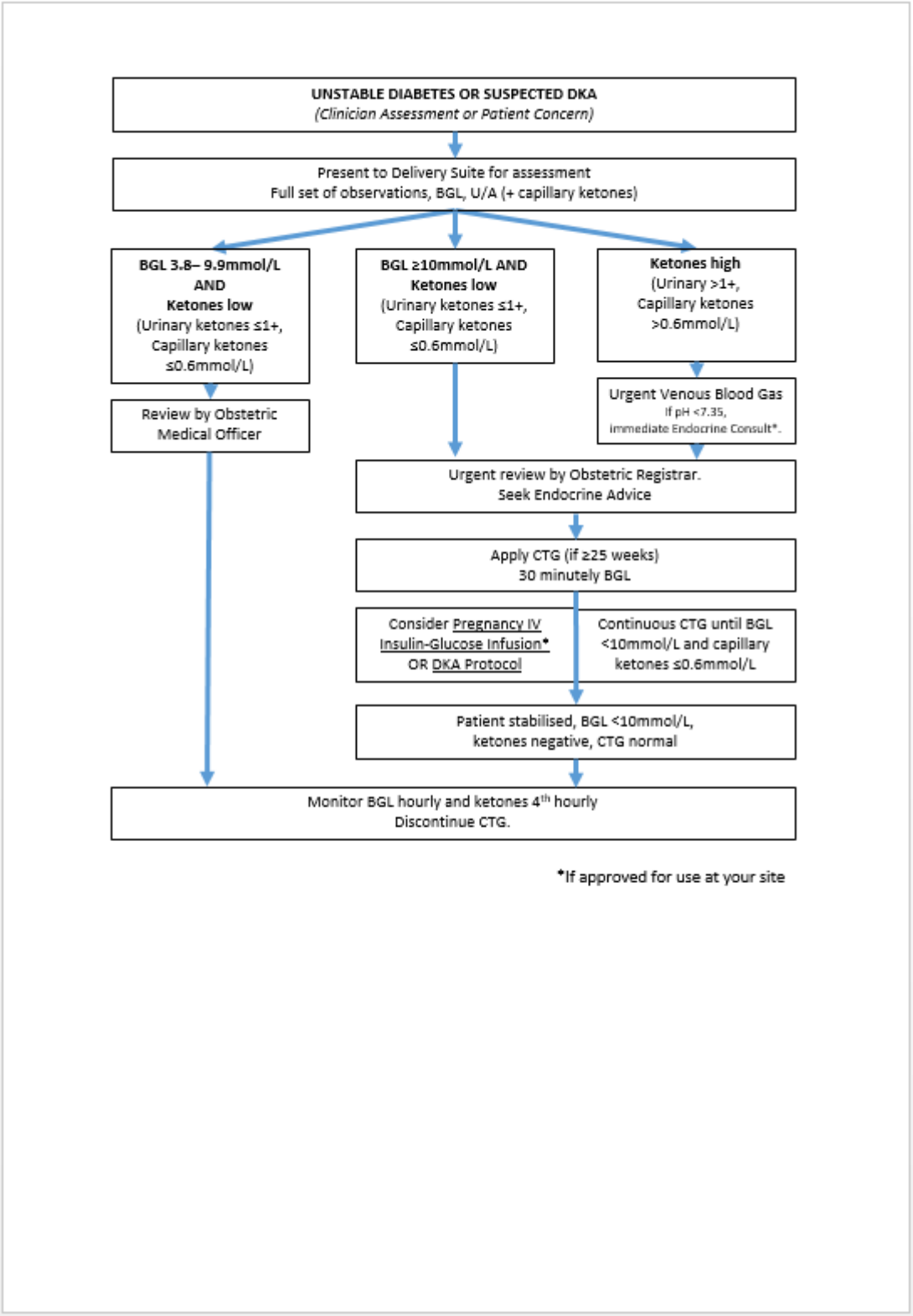
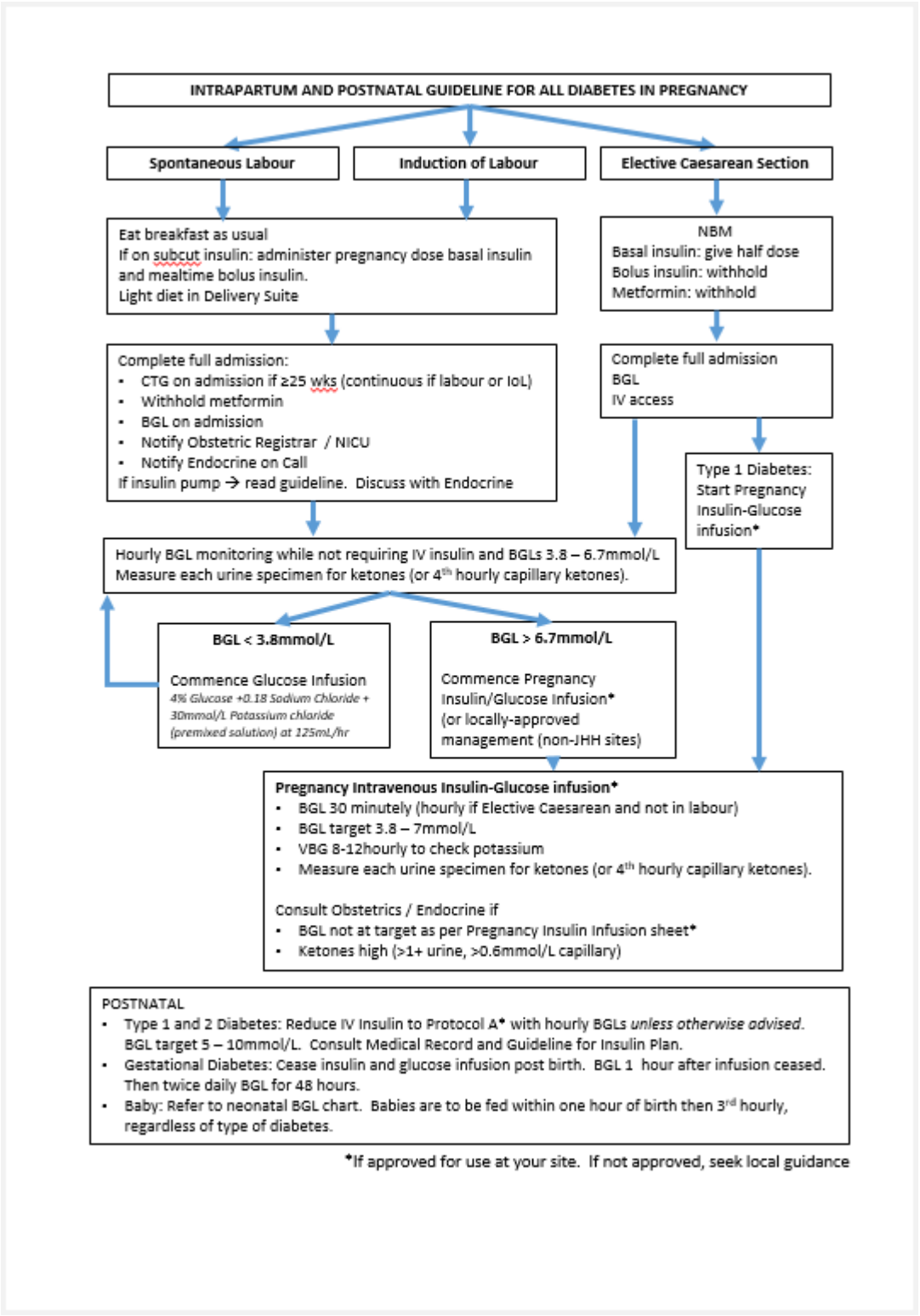
APPENDIX 2: Glycaemic Management following Antenatal Betamethasone



APPENDIX 3: Flowchart for Inpatient Management of Unstable Diabetes Mellitus in Pregnancy



APPENDIX 4: Intrapartum and Postnatal Flowchart for all diabetes in pregnancy



APPENDIX 5: Pre-existing Diabetes: Standard Pathway for Antenatal Care

Gestation	
First Appointment; 5–14 weeks	Midwife arrange: • Dating scan, NT scan • Antenatal bloods, HbA1c, B12 • TSH (if Type 1 Diabetes, BMI > 40) • Urinary Albumin: Creatinine ratio • Booking In Visit • Obstetrician Visit / GP obstetrician • Endocrinology Team review within 1 week Discuss care of diabetes per Guideline.
Booking In Visit; 12–14 weeks	Document in considerations (e-maternity) diabetes type Book scans in MFMU – 20, 24, 28, 32,36 weeks or with high risk outreach clinic Urinalysis + urine ACR and weight Discuss possibility of special care nursery admission for baby & antenatal expressing Obstetrician visit/ GP obstetrician Endocrinology review Organise Ophthalmology review
16 weeks	Endocrinology team review
18 weeks	Endocrinology team review Midwifery visit (including urinalysis & weight)
20 weeks	Scan – morphology Obstetrician/Endocrine (combined visit) (or High risk outreach clinic) Bloods; HbA1c Offer influenza vaccine (in flu season)
22 weeks	Endocrinology team review Ophthalmology review Renal, thyroid & B12 bloods
24 weeks	Scan Midwife visit (Obstetrician review scan) or high risk outreach clinic U/A & weight Endocrinology team review

26 weeks	Endocrinology team review HbA1c (negative blood group – BGA & FBC)
28 weeks	Scan Obstetrician/Endocrine (combined visit) or high risk outreach clinic (Negative blood group anti-D) Offer pertussis vaccination
30 weeks	Midwife visit U/A & weight Referral for NICU/SCN tour at 34 weeks Endocrinology team review
32 weeks	Obstetrician/Endocrinologist (combined visit) or high risk outreach clinic (intrapartum and post-partum treatment plan documented) Ophthalmology review Bloods: Renal, Hb, blood group antibodies, HbA1c
34 weeks	Midwife visit / Referral to lactation consultant if available due to increased risk of mastitis postnatally (Negative blood group anti-D) Antenatal expressing video NICU/SCN tour U/A & weight Check E-maternity is up to date Endocrinology team review
35 weeks	Obstetrician – finalise birth plan & book IOL or C/S as indicated GBS swab Endocrine team review (if required) OK given for antenatal expressing from 36 weeks Give expressing equipment U/A & weight
36 weeks	Midwife visit (& high risk outreach clinic as indicated) U/A & weight Endocrinology team (intrapartum and post-partum treatment plan reviewed & documented) Dietitian to review if planning to breastfeed

37 weeks	Obstetrician / GP Obstetrician Midwife- VE prior to planning for cervical ripening as indicated 1 week prior Endocrinology team (if required) U/A & weight Ensure postnatal appointment made (6–12 wk) with GP & endocrinologist

APPENDIX 6: Gestational Diabetes: Standard Pathway for Antenatal Care

Stage	Provider	Checks
At referral (any gestation)	Diabetes Educator and Dietitian Group Session (at JHH: group Session every Tuesday and Thursday booked through ANC) Education session as per other facilities arrangements	Introduction to Diabetes in Pregnancy Clinic (DIP) team/Contact numbers Education on self-management and dietary requirements Given information package, including postnatal OGTT request form
1 week following group session (any gestation)	Diabetes in Pregnancy (DIP) Clinic or with GP / obstetrician as per facility Team should include Diabetes Educator, Dietitian, Diabetes Specialist, Obstetrician and Midwife	Diabetes summary, problem list and management plan Review BGL monitoring and decide if treatment required Bloods (if not done recently) – EUC, FBC, LFT, TSH, HbA1c, B12 Decide if for usual obstetric care or GP Shared Care
10 to 14 weeks	DIP team (due to early presentation of gestational diabetes, considered higher risk)	Fortnightly appointments in JHH ANC or facility or GP / obstetrician Review BGL monitoring Review any blood tests Nuchal translucency scan before 14 weeks
15 to 20 weeks	DIP team	Fortnightly appointments in JHH ANC or facility, GP / obstetrician, or high risk outreach clinic. Review BGL monitoring Review blood tests (if any) and nuchal translucency scan Arrange a morphology and placental site scan
20 to 24 weeks	DIP team (or General Practitioner if shared care has been agreed to by all parties, and following first visit with DIP team) May be referred back to usual care with pathway for monitoring BGLs & referral back to higher level care if outside targets at any time in pregnancy	Fortnightly appointments in JHH ANC or with general practitioner / obstetrician as per facility or high risk outreach clinic Offer influenza vaccine (in flu season) Review BGL monitoring (refer to targets and advice regarding when to refer back to DIP team) Review blood tests (if any) and morphology scan

24 to 28 weeks	DIP team (or General Practitioner if shared care has been agreed to by all parties, and following first visit with DIP team) May be referred back to usual care with pathway for monitoring BGLs & referral back to higher level care if outside targets at any time in pregnancy	Fortnightly appointments in JHH ANC or facility or GP / obstetrician or high risk outreach clinic Review BGL monitoring (refer to targets and advice regarding when to refer back to DIP team) Review blood tests (if any) Organise FBC and BGA (if neg blood group) To see Diabetes educator and Dietitian at this visit if diagnosed gestational diabetes early (as required) Arrange for 30/40 growth, liquor & Doppler scan
28 to 32 weeks	DIP team (or General Practitioner if shared care has been agreed to by all parties, and following first visit with DIP team) May be referred back to usual care with pathway for monitoring BGL & referral back to higher level care if outside targets at any time in pregnancy	Fortnightly appointments in ANC, general practitioner, GP obstetrician, or high risk outreach clinic Review BGL monitoring (refer to targets and advice regarding when to refer back to DIP team) Review blood tests (if any) Give anti-D (if neg blood group) Offer pertussis vaccination
32 to 34 weeks	DIP team (or General Practitioner if shared care has been agreed to by all parties, and following first visit with DIP team) May be referred back to usual care with pathway for monitoring BGL & referral back to higher level care if outside targets at any time in pregnancy	Fortnightly appointments in ANC, general practitioner, GP obstetrician or high risk outreach clinic Arrange for growth, liquor & Doppler scan at 36 weeks Review BGL monitoring (refer to targets and advice regarding when to refer back to DIP team) Review blood tests (if any) Arrange for bloods, FBC and BGA (anti-D if neg) Referral to lactation consultant if available due to increased risk of mastitis postnatally
36 weeks to birth	DIP team	Review: • BGL monitoring • Blood tests • Growth scan

	• GBS swab collect/review Obstetrician / GP obstetrician to discuss birthing plan and book IOL or ELSCS. Approve antenatal expressing Midwife, discuss antenatal expressing and arrange NICU tour Diabetes Educator and Dietitian review for postnatal advice and type 2 risk reduction Woman given request form for 6-week postnatal GTT Midwife- VE prior to planning for cervical ripening as indicated 1 week prior
6 to 12 weeks post-partum	Remind woman of importance of postnatal 75 g GTT Review results with woman

APPENDIX 7: Clinical Audit Tool

(**National Standard 1:** 1.7.2 The use of agreed clinical guidelines by the clinical workforce is monitored)

Criterion no.	Criterion	Exceptions	Definition of terms and/or general guidance	Data source	Frequency	Position Responsible
1	*Recorded IIMS relating to women with diabetes in pregnancy*	*None.*	*Recording of incidents reported through the IIMS system relating to care of the woman with diabetes in pregnancy & the care provided in relation to diabetes & the guideline developed as required by the woman*	*Reported IIMS incidents*	*12 monthly*	*Birthing Unit Facility Manager*
2						
3						
4						
5						

Reference: *Electronic audit tool - National Institute for* Health *and Clinical Excellence (NICE):*