OBSTETRICS AND GYNAECOLOGY
CLINICAL PRACTICE GUIDELINE

Diabetes

Scope (Staff):	WNHS Obstetrics and Gynaecology Directorate staff; Physicians
Scope (Area):	Obstetrics and Gynaecology Directorate clinical areas at KEMH, OPH and home visiting

This document should be read in conjunction with this Disclaimer

Contents

Diabetes (obstetrics and gynaecology)

Hypoglycaemia management

Recognise and respond early to acute deterioration.

If requiring immediate medical attention, consider Code Blue Medical Calling Criteria.

The medical team the patient is admitted under also need to be involved in collaboration with the physicians.

Aim

Women with type1, type2 and gestational diabetes mellitus (DM) and **who are using insulin or oral medications** will be provided with the knowledge and skills to be able to:

- Recognise the signs and symptoms of hypoglycaemia
- Be able to adequately treat hypoglycaemia
- Recognise the reason for hypoglycaemia and take steps to avoid a reoccurrence

Key points

1. Hypoglycaemia is defined as a blood glucose level (BGL) < 4.0 mmol/L.
2. Hypoglycaemia with mild or no symptoms is usually successfully treated with a fast-acting carbohydrate (see below) followed by a snack or meal.
3. Symptomatic hypoglycaemia in a patient **treated with insulin or an oral hypoglycaemic agent (OHA)** is an emergency and requires prompt correction.
4. Women who are **not** on insulin or OHAs do not require treatment unless their blood glucose level is <3.5mmol/l.

Signs and symptoms

Adrenergic symptoms (sympathetic nervous system)	Neuroglycopenic symptoms	
• sweating • tremor • anxiety • pallor • palpitations • tachycardia	• confusion, drowsiness • inappropriate behaviour • perioral and peripheral tingling • diplopia • slurred speech	• hunger • headache • unsteady gait • aggressive behaviour • convulsions, coma
Note: Many women recognise early warning signs and treat themselves. However, with confusion or drowsiness, the patient may be unable to initiate treatment.		

Conscious patient: Management

Give fast acting carbohydrate, e.g.:

- sweet drink – one glass (100mL) of cordial, soft drink (NOT diet drink)
- five to six jellybeans
- 3 teaspoons honey
- two to three sweet biscuits
- three barley sugars
- glucose gel 15g (glutose): Check BGL as soon as practical

Repeat above treatment if symptoms persist or BGL < 4.0 in 15 minutes.

Follow up

- Follow up with a longer acting low GI carbohydrate, e.g.:
  - Sandwich
  - Snack e.g. fruit and / or 2 – 4 cracker biscuits and cheese
  - Meal
- Recheck BGL in 2 hours or sooner if the woman is symptomatic of hypoglycaemia.
- Discuss the possible causes of the hypo with the woman (preventative management) and adjust insulin regimen if required (discuss with diabetes team).

Unconscious, uncooperative patient and/or code blue medical criteria

- Call for help: Dial 55 - 'Code Blue Medical'
- If glucagon (Glucagon®) is available, give intramuscularly. If the woman is not responding within 10 minutes IV glucose is required.
- Set up / obtain IV access.
- Give IV 50% Glucose.
  - See section in Adult resuscitation drug protocols and 'Hypoglycaemia Management in Diabetes' on BGL monitoring form
- Leave IV cannula for at least 6 hours as hypoglycaemia may recur.

Follow–up

- Once the woman is fully alert and cooperative, provide her with a snack or meal (e.g. glass of milk, dry biscuits and cheese/ sandwiches)
- Repeat BGL in 20 –30 minutes and if > 4.0mmol/L repeat in 1 hour.
- Document all BGLs, IV / IM treatment and food/drink ingested on MR 265.
- Notify Physician/ Credentialed Diabetes Educator to review insulin regimen where practical.
- Discuss with the woman the possible causes of the hypo (prevention management), insulin adjustment may be required (discuss with diabetes team).

Diabetic ketoacidosis (DKA) management

Recognise and respond early to acute deterioration.

If requiring immediate medical attention, consider Code Blue Medical Calling Criteria.

The medical team the patient is admitted under also need to be involved in collaboration with the physicians.

Aims

- To provide clinical staff with the information to be able to manage diabetic ketoacidosis (DKA) appropriately.
- Staff shall be able to:
  - Define hyperglycaemia in pregnancy
  - Distinguish between hyperglycaemia, diabetic ketoacidosis and hyperosmolar hyperglycaemic state
  - Respond appropriately when blood glucose results are abnormal

The Physician on call MUST be notified of all women admitted with suspected DKA BEFORE extensive management plans have been made or started.

Background

In the absence of prompt diagnosis and treatment DKA can be life threatening to both the mother and the fetus.

Diabetic ketoacidosis is:

- a life-threatening metabolic complication of absolute insulin deficiency
- characterised by the triad of:
  - Hyperglycaemia
  - Ketonaemia from fatty acid metabolism
  - Metabolic acidosis.

The resulting hyperglycaemia results in loss of water and electrolytes, hyperosmolality and fluid depletion.

Although more commonly associated with Type 1 diabetes, DKA can also occur in Type 2 or gestational diabetes in the context of severe illness such as sepsis, insulin disruption, myocardial infarction or medication administration (e.g. corticosteroids).

As a general rule:

- Stabilise maternal condition
- Continue close fetal surveillance
- Consider delivery if despite aggressive therapy fetal status does not improve or maternal condition continues to deteriorate.

Diagnosis

The diagnosis of diabetic ketoacidosis is made on the basis of a compatible history (including polyuria, polydipsia, vomiting, abdominal pain, weight loss, dehydration, precipitating infection or event) and:

- Hyperglycaemia, typically BGL>13mmol/L but may be lower or normal in pregnancy
- Metabolic acidosis (pH<7.30) with high anion gap
- Presence of ketones in urine or serum

The most common precipitants for DKA are:

- omission or inadequate dosing of insulin
- infection (pneumonia, UTI, gastroenteritis, viral)
- hyperemesis
- medical / surgical intercurrent illness such as pancreatitis
- steroid induced hyperglycaemia after administration for fetal lung maturation
- β2 agonists (e.g. salbutamol, terbutaline) for tocolysis can cause and further aggravate DKA.

Remember, in addition to the usual symptoms and signs of DKA, pregnant women can also present with non-specific abdominal pain and / or contractions.

Differential diagnosis includes acute pancreatitis, alcoholic ketoacidosis, appendicitis, cystitis, hyperosmolar coma, lactic acidosis, salicylate toxicity and septic shock.

Assessment

Initial investigation for diabetic ketoacidosis should include:

1. BGL (laboratory and fingerpick): Check hourly
2. Arterial blood gases
3. Urine and serum ketone level (blood β – ketone testing can be done using the Optium meter)
4. Urea and electrolytes
5. Considering the precipitating cause/s and manage as appropriate. These could include:
    - Newly diagnosed Type 1 diabetes or Type 1 with missed insulin doses
    - Insufficient insulin for intercurrent illness e.g.
        - infection (consider CXR, MSU, blood cultures, meningism).
        - ischaemic event e.g. AMI (may be silent, check ECG), CVA, ischaemic bowel, gangrene
        - acute abdomen e.g. pancreatitis, peritonitis
        - drugs (alcohol, glucocorticoids, sympathomimetics)

Treatment

The Medical Registrar or Diabetes Physician must be contacted regarding the management of DKA.

All patients with DKA should be monitored in a high dependency unit (ASCU) or labour and birth suite. At KEMH the duty anaesthetist must be informed of all ASCU admissions (and / or labour and birth suite if the patient is in DKA).

Consider:

1. Urinary catheter (if not producing urine after 3 hours).
2. Arterial line
3. Nasogastric tube (if drowsy / vomiting).

Transfer to an ICU may be required if:

- severe ketoacidosis (pH < 7.0)
- altered consciousness
- poor response to acute resuscitation
- more intensive monitoring anticipated (e.g. serum potassium (K^+), intercurrent illness)

Volume expansion

The treatment of DKA includes correction of dehydration (typical water deficits are 5 - 10L), hyperglycaemia and electrolyte imbalance, (the most dangerous of which is hypokalaemia) combined with treatment of the provocative illness and frequent maternal monitoring. Aim to replace total volume loss in 24-36 hours, with approximately 50% of the resuscitation fluid being administered in the first 8-12 hours.

Sodium chloride 0.9%

- Use for initial resuscitation
- Consider:
  - 1 – 2 L in the first hour
  - 500-1000mL / hour over the next 2-4 hours

Insulin infusion

- If the patient is already on long acting insulin, this should be continued.
- 50 units **Actrapid ®** in 50mL 0.9% sodium chloride (i.e. 1 Unit/mL) via infusion pump; flush the fluid through and discard the first 10 mLs.
- Commence the infusion at **6 mL/hr** (i.e. 6 units per hour). An Insulin bolus may be given if recommended by the physician.
- **Repeat ABG's** at 2 - 4 hours to check acidosis is being corrected, according to the discretion of the physician.

  *(Venous Blood Gases may be acceptable with less severe acidosis - check that the bicarbonate is rising).

Potassium (K^+)

Patients with DKA may be depleted in total body potassium despite normal or even elevated potassium on presentation. Initially the potassium may be high due to acidosis but will fall rapidly when acidosis is corrected. The key to adequate potassium replacement is regular monitoring (1-2 hourly). An arterial line is recommended, and arterial blood gas can give rapid information on the potassium level.

- Potassium <3.5, give 10mmol/L potassium chloride (KCl) per hour IV. Recheck every 1 – 2 hours. If higher doses are required consider the insertion of a central line, cardiac monitoring and ASCU admission.
- Potassium = 3.5-5.5, give 20 mmol/L KCl over 1-2 hours IV. Recheck prior to any further administration.
- Potassium > 5.5, no replacement.

For further information regarding potassium chloride administration, refer to WNHS Adult Medication Monograph: Potassium Chloride

Bicarbonate

- Randomised trials outside pregnancy have not shown any benefit from bicarbonate therapy in patients with pH 6.9-7.1, although there are no studies in pregnancy.
- In pregnancy, the normal pH is 7.4-7.45, so a pH of 7 represents severe acidosis and bicarbonate may be considered. **Patients in this situation should be considered for transfer to an Intensive Care Unit or considered for delivery.**

Phosphate

Not usually indicated. May be considered if severe hypophosphataemia (<0.35mmol/L) +/- cardiorespiratory depression

Glucose 10%

- Commence at 40mL/hour when BGL <10 mmol/ hour to be run concurrently with 0.9% sodium chloride (as needed to restore euvolaemia).
- Check the BGL and ketones hourly.
- If the capillary ketones are not falling by 0.5mmol/L/hour, increase the insulin by 1 unit/hour.
- If the blood glucose continues to fall below 7.0 within the first hour, consider increasing the glucose infusion rate to 80mL/ hour and contact the physician

IV Infusions are to be ceased only when:

- acidosis is corrected (i.e. blood ketones<0.5)

  and
- the patient is able to eat normally (to allow the safe recommencement of subcutaneous insulin)

NB If patient normoglycaemic or becomes hypoglycaemic with IV insulin, **do not cease the insulin infusion until acidosis is corrected** (extra glucose and/or an increase in the glucose infusion rate can be administered).

Conversion to subcutaneous insulin

Once the ketones have been cleared and if the patient is eating and drinking normally, the patient should be transferred to subcutaneous insulin therapy by the diabetes team

For patients with known diabetes on multiple daily injections:

- Recommence the usual bolus insulin with the patient's next meal
- Cease infusions:
  - Half an hour after rapid onset subcutaneous insulin given.
  - Basal insulin must be arranged with diabetes team prior to cessation of insulin infusion.
  - **5-10 minutes** after the administration of fast acting analogues (Novorapid, Humalog, Apidra). For products available at WNHS see Pharmacy guideline: Medications: Insulin.

For patients who are on CS11 (insulin pump) therapy:

- Consider that the cause of DKA could be a result of pump failure; evaluate this prior to restarting the pump
- Seek advice from the physician
- If appropriate, recommence the pump when the ketones have cleared and the patient is eating and drinking.
- Cease the insulin infusion 30 minutes after recommencing pump.

Perinatal complications

The frequency and severity of perinatal complications is dependent upon the severity of the maternal condition at the time of presentation, adequacy of management, and the gestational age and condition of the fetus prior to onset of the DKA. The reported fetal mortality in recent years has ranged from 10-36%. Perinatal morbidity is high due to preterm delivery, hypoxia and acidosis

Effect of DKA on the fetus

The mechanism of fetal loss is not clear but believed to be due to:

- Massive osmotic diuresis and consequent dehydration, which leads to volume depletion and reduced utero-placental blood perfusion.
- Maternal acidemia is known to reduce placental blood flow with resultant fetal hypoxia.
- Maternal hypophosphatemia leads to altered red blood cell oxygen metabolism causing further fetal hypoxia.

- Fetal hyperinsulinemia resulting from maternal hyperglycaemia leads to increased fetal oxygen requirements by stimulating oxidative metabolic pathways, further aggravating the insult.
- Maternal hypokalaemia can potentially cause fetal hypokalaemia, leading to fatal arrhythmias.

Management of DKA – Fetal monitoring:

- The mode and intensity of fetal monitoring will largely be influenced by gestational age at time of DKA and by other pregnancy risk factors and past obstetric history.
- Decisions regarding the type and intensity of fetal surveillance at gestations under 28 weeks are difficult and should be individualised and made at a consultant level. The MFM consultant's opinion should be sought.
- Usually with gestations over 28 weeks, continuous fetal heart rate (FHR) monitoring is recommended and should be commenced at the time of diagnosis and continued until the mother is stabilised with correction of the majority of metabolic derangements. It may sometimes be necessary to continue the CTG until the FHR abnormalities disappear and this may take 4-8 hrs.
- NB: all modes of fetal testing will be influenced by the fetal hypoxemia and acidosis.
- FHR abnormalities, not uncommonly seen during an acute DKA episode are:
  - minimal or absent variability
  - absent accelerations
  - repetitive variable or late decelerations
- Consider an ultrasound scan to check fetal well-being, especially in very preterm gestations where CTG is more difficult to interpret and other situations where these findings may help with delivery decisions.
- USS findings are quite often abnormal and show:
  - abnormal biophysical profile
  - abnormal umbilical artery Doppler
  - abnormal middle cerebral artery Doppler with evidence of redistribution.
- The frequency and severity of fetal abnormalities are directly related to the severity and duration of the episode and appropriateness of its management.
- Most fetal abnormalities will usually improve after correction of the metabolic derangements and maternal stabilisation.
- The decision to continue the pregnancy or to proceed with delivery in the setting of DKA can be very challenging and should be made at the consultant level. The MFM consultant's opinion should be sought if possible. These decisions should consider:
  - The gestational age of the fetus

  - The maternal status and the fetal status
  - The response to treatment
  - The background medical history of co-morbidities and past obstetric history
- Resist the natural inclination to proceed with an urgent C-section for FHR abnormalities, prior to stabilisation of the maternal condition.
- DKA on its own is NOT an indication for urgent delivery as this increases both maternal morbidity and mortality and also leads to the delivery of a hypoxic, acidotic and usually preterm neonate.

DKA management protocol tables

Volume expansion (with potassium as per protocol)

Fluid	Additives/ Batch no.	Vol	Rate
Sodium Chloride 0.9%	NIL	1L	
Sodium Chloride 0.9%		1L	

Insulin infusion (flush and discard first 10mL)

Fluid	Additives/ Batch no.	Vol	Rate
Sodium Chloride 0.9%	Actrapid 50 units	50mL	6mL/hr

Glucose (to commence when BGL <10)

Fluid	Additives/ Batch no.	Vol	Rate
10% Glucose		1L	40mL/hr

Documentation and relevant forms

- MR 731 ASCU Observation Chart
- MR 740 Intravenous Fluid and Additive Order Form
- For obstetric patients:
  - MR 265.01 Insulin Infusion Chart for Obstetric Women
  - MR 265.04 Subcutaneous Insulin Order and Blood Glucose Record – Obstetric
- For gynaecology / non-obstetric patients:
  - MR 265.02 Insulin Infusion Chart for Gynaecology Patients
  - MR 265.03 Insulin Subcutaneous Order and Blood Glucose Record - Non Obstetric

Monitoring

Blood glucose meter –Optium Neo H

Key points

1. Ensure that the sensor and sensor electrodes are at room temperature. The operating temperature range is 18° to 30° C.
2. If the sensor is moved to an area that is warmer or cooler than its original place, allow 10 - 12 minutes for it to reach the new temperature.
3. The relative humidity range is 10% to 90%
4. The Optium Neo H blood glucose meter must be correctly coded to the pack of strips in current use.
5. Monthly monitoring of the hospital Optium Neo H blood glucose meters is required through the 'MediPro glucose monitoring quality assurance program' which is coordinated through the diabetes service.

Equipment required

- Optium Neo (H) blood glucose meter portable workstation (available on each ward and department).
- Optium "Freestyle (H)" Blood Glucose Sensor Electrodes (available from pharmacy). NB: The letter 'H' denotes that these electrodes are for hospital use only.
- Lancing device prepared for use (available from stores).

Important warning

Women with diabetes may have their own Optium Xceed blood glucose meter. The Optium home meters use different strips called "FreeStyle Optium" blood glucose strips which do not require coding and **do not have the letter 'H' on the box**.

These are not interchangeable with hospital strips and must not be given to women to use in their own meters.

NDSS (National Diabetes Supply Scheme)

- The diabetes service is a sub agent for NDSS as are most chemists.
- All women who attend the Diabetes Service are registered with the NDSS (excluding overseas visitors).
- Women requiring test strips (for any meter) or insulin pen needles may access their supplies through NDSS as subsidised prices.

Completing a blood glucose test using the ward / department meter

	PROCEDURE	ADDITIONAL INFORMATION
1.	Perform hand hygiene.	Make sure hands are thoroughly dry before handling sensor electrode and testing
2.	Check the expiry date on the packet	Expired sensor electrodes may give false results.
3.	**Calibration procedure** With lot number facing toward you, insert contact bars of the calibrator into the monitor. 'LOT' and number appear in the display window. Check that the numbers match.	A calibration sensor is in every pack of electrodes.
4.	Open a sensor electrode packet by tearing diagonally at the notch in the foil.	Tear off the smaller end of the packet so that the contact bars of the sensor electrode are showing. Don't cut the sensor electrode.
5.	Pull the electrode out of the packet.	You can use the packet later to discard the used electrode.
6.	Insert electrode with contact bars, facing up, into the sensor test port.	Damaged sensors may give inaccurate results.
7.	Push the electrode in until it stops. The sensor turns on automatically. **LOT =,** the five-digit lot number and then **Apply Blood** appear in the display window.	The sensor will turn on by itself.
8.	Check that the lot number displayed matches the lot number on the calibrator bar and the electrode package insert for the electrodes currently in use.	
9.	Obtain a hanging drop of blood using your lancing device and the correct technique.	
10.	Touch the blood drop to the white target area of the electrode while **Apply Blood** appears in the display window. Gently hold your finger on the target area while the blood drop is drawn into the electrode.	The test will start when the blood sample is detected.
11.	Move your finger away from the target area when the display shows -	Once enough blood has collected the sensor displays ---,--,- and then the countdown.

-- (three dashes).

12.	After the countdown, your blood glucose result will appear. Record the result.	The result is also stored in your sensor's memory.
13.	Your sensor will automatically turn off 30 seconds after result is displayed.	You can also press the button to turn your sensor off.
14.	Remove the electrode and discard it properly.	You may slip the electrode into the opened foil packet to remove and discard.

Continuous glucose monitoring (CGM) devices

Overview

Continuous glucose monitoring (CGM) can help in managing diabetes and is currently fully subsidised through the National Diabetes Services Scheme (NDSS) for children and young people with type 1 DM. The cost for those who are not eligible for CGM is $4000 - $5000 per year and is not covered by private health insurance.

Currently women with type 1 DM who are pregnant or planning pregnancy, can access government funded CGM through NDSS. Using CGM has been shown to positively impact pregnancy outcomes in women with type 1 DM.

Continuous glucose monitors are small wearable devices that measure and show glucose levels at all times. These devices measure interstitial glucose **NOT** blood glucose. CGM can reduce the number of finger prick checks needed however, it does not replace blood glucose monitoring entirely. Blood glucose levels and interstitial glucose readings will not be exactly the same.

There are three main parts:

- SENSOR: Sits on the abdomen with a small electrode inserted just under the skin.
- TRANSMITTER: Attaches to the sensor and sends glucose reading to the wireless receiver, insulin pump or compatible smart phone.
- RECEIVER: allows viewing of glucose data. May be a standalone device, insulin pump or compatible smartphone via an app.

This information is reviewed to help make decisions regarding management.

CGM does not entirely replace blood glucose monitoring:

- CGM devices need calibrating at least twice daily by entering a **BLOOD** glucose reading.
- When hypoglycaemia is known or suspected, **BLOOD** glucose levels should be checked.
- Check **BLOOD** glucose levels if glucose levels are changing rapidly or symptoms do not match the CGM readings.

- When glucose levels are high always check **BLOOD** glucose levels prior to giving a correction dose of insulin.

Inpatient management

Type 1 women who meet the criteria for subsidy and are attending this hospital are taught how to manage CGM devices and fully understand the results by the diabetes educators and obstetric physicians.

Reference
National Diabetes Services Scheme (NDSS) CGM fact sheet (2022)

Insulin pen devices

Key points

1. Women with diabetes are encouraged to be self-managing and continue to use their own insulin pen devices and needles.
2. **However, as there is real risk of needle stick injury, staff should not under any circumstances recap and/or remove a standard pen needle from an insulin pen.**
3. Where a patient is unable to complete the process of removing and disposing of the needle, **staff should use a safety pen needle (BD AutoShield ™ Duo) available in all areas and suitable for all insulin pens.**
4. Staff assisting women to give insulin shall attend in-service on insulin pen devices.
5. Staff shall contact the Diabetes Service (6458 2163) if unfamiliar with the insulin pen device in use.

Storage and labelling

Refer to WNHS Pharmacy guideline: Insulin Storage and Handling of Insulin (available to WA Heath employees through HealthPoint)

Staff instructions: Using patient pen devices

Use of BD Autoshield™ duo safety pen needle (staff)

1. When a patient is unable to complete the process of removing and disposing of the **pen** needle **staff should use the AUTOSHIELD ™ DUO SAFETY PEN NEEDLE and administer the insulin.**
2. **AUTOSHIELD ™ DUO SAFETY PEN NEEDLE are not for patient's use. They are for staff use only**
   - Take the Peel Tab off the pen needle. Holding the outer cover, push and twist the pen needle onto the pen in a clockwise direction until it meets resistance.
   - Pull ONLY the outer cover straight off.
   - Always check the flow in the pen needle before each injection by priming the

device with an airshot (dial 2 units) repeat if needed.

- Dial prescribed dose on the pen, place pen on skin at 90-degree angle and with slight pressure the needle will automatically be inserted into the skin.
- Maintain this pressure on the skin as you deliver the dose (by pressing the button with your thumb) and continue the pressure on the skin for a further 6 seconds allowing the insulin dose to be fully administered.
- Do not inject with the needle pointing at an angle toward your fingers. This may result in a needle stick injury.
- Once dose is fully delivered lift pen away from the skin. The Inner Shield will automatically deploy and lock in place.
- A Red Indicator Band will appear confirming Shield is locked in place and that the Pen Needle has been used.
- Always hold the Pen Needle by the White Sleeve when removing. Twist pen needle in an anticlockwise direction to remove needle from the pen.
- Pen Connection end is protected – confirmed when orange shield deploys and covers the needle.
- DO NOT PLACE YOUR FINGERS ON THE ACTIVATED SHIELDS.

Patient instructions: Using own devices and needles

Use of an insulin pen device

- Wash and dry hands.
- Remove the Pen cap.

Attaching the needle

- Remove the protective tab from patient's insulin pen needle and screw the needle securely onto the Pen.
- Pull off the clear outer and keep to remove needle after injection
- Pull off inner needle cap when ready to inject, and discard.
- Do not discard the clear outer needle cap.

Injecting a dose

- Re-suspend cloudy insulin by rocking / rolling the pen until the insulin is uniformly suspended.
- **Prime pen prior to each injection as follows:**
  - Dial 2 units by turning the dose selector forward.
  - Hold FlexPen with the needle pointing up. Tap the reservoir gently with your finger a few times to make sure any air bubbles collect at the top.
  - With the needle still pointing upwards, press the Push Button fully in until the dose selector returns to zero. A drop of insulin should appear at the needle tip.

- If not, repeat the air shot up to 6 times until a drop of insulin does appear. If a drop still does not appear, do not use your FlexPen.

Dose selection:

- Ensure the Push Button is fully depressed and the dose selector is set at zero. Dial the number of units required by turning the dose selector in a clockwise direction.
- The dose can be corrected both up and downwards.
- You cannot set a dose larger than the number of units remaining in the reservoir. 60 units is the maximum dose.

Injection of insulin:

- Pinch your skin between two fingers, push the needle into the skin fold and then inject the insulin by pressing the Push Button down fully with your thumb.
- Be careful to only press the Push Button when injecting
- Leave the needle under the skin for at least 6 seconds. Keep the Push Button fully pushed in until you remove the needle from the skin this will ensure that the full dose is given.

Removing the needle

- Replace the clear outer needle cap and unscrew the needle. Dispose of it into a sharp's container.
- It is important that you use a new needle for each injection.
- Replace the FlexPen cap and store the FlexPen you are using in the refrigerator or below 25 degrees Celsius.
- Insulin can be kept at room temperature (less than 25 degrees Celsius) for 30 days from opening. After this time, the insulin pen should be discarded.
- FlexPen not in current use must be stored in the refrigerator between 2-8 degrees.

Function check

If your pen is not working properly, follow this procedure.

- Screw on a new pen needle.
- Prime pen
- Dial 20 units and put the outer needle cap into the needle.
- Dispense 20 units into the needle cap holding the pen with needle pointing down.
- The solution will fill the lower part of the cap to the top of the phalanges on the cap.
- If pen has released too much or too little, repeat the test. If it happens again do not use the pen.

Insulin infusion pump management - inpatient

Aim

- To enable individuals whose diabetes is being treated in the outpatient setting with a continuous subcutaneous insulin infusion (CSII) can continue to be managed safely with their insulin pump during their hospitalisation.

Key points

1. Hospital staff should assume, unless otherwise advised, that the only person who can manage the pump during their hospitalisation is the patient.
2. Any changes in insulin administration will need to be made by the patient who must be competent in managing the pump and physically and mentally able to accept and institute these recommendations.

Competency

Any patient who is admitted to hospital using an insulin pump must be assessed for their competency to use their device. If they can demonstrate their physical and mental competency to manage the device, the patient should be allowed to continue on their insulin pump.

On admission to hospital, either to a ward or Emergency Department, the patient must demonstrate to the satisfaction of the assessing health professional that they have the ability to use the management program of the device and understand how to modify the program.

The diabetes educator or diabetes physician on call for the hospital should be notified upon admission of a patient with an insulin pump. An urgent consultation should be obtained if there is a concern about competency of the patient to continue on pump therapy. It may be possible to rectify any issues or concerns, allowing the patient to continue on their insulin pump.

If the patient is not proficient with their pump, the physician on call may institute alternative therapy.

Contraindications

The use of the CSII is contra-indicated in situations where the patient's safety may be compromised by the physical illness or mental state of the patient.

Contra-indications for CSII using an insulin pump are:-

- Patients with an impaired level of consciousness.
- Labour and birth is not an absolute contraindication to the use of an insulin pump and may be used as determined by the physician.
- Patients with critical illness requiring intensive care.
- Patients with major psychiatric disturbance.
- Diabetic ketoacidosis. Patients refusing or unwilling to participate in self-care.

- Lack of infusion sets, spare batteries and other equipment required to maintain patient on CSII therapy.
- Any other medical circumstance deemed unsuitable by the supervising medical officer.

Any discontinuation of pump therapy should be preceded by a discussion with the diabetes physician, diabetes educator and obstetric team.

Documentation

Before a patient continues on CSII as an in-patient, the following criteria must be documented:

- It must be clearly written in the medical record and on the blood glucose monitoring form that the patient is on an insulin pump.
- The brand name and model of the pump must be written in the medical record.
- The type of insulin used in the insulin pump must be identified and recorded in the blood glucose monitoring form.
- The current basal and bolus insulin doses (in insulin to carbohydrate ratios) must be documented in the medical record and the blood glucose monitoring form. Also document if any changes are required.
- That competency has been assessed and deemed satisfactory, as per above section.
- The patient agrees to notify the medical staff of any changes they make to their insulin pump.

Consultations

The following health professionals should be consulted.

- Diabetes Physician.
- Diabetes Educator.
- Dietitian.

Insulin adjustment

- Changes to the patient's insulin therapy may be made at any time by the patient provided the change is notified to the diabetes educator / medical staff, as stated above.
- Any change to the insulin regimen recommended by the diabetes educator /medical staff will be documented in the medical record and confirmed by the patient at the time of implementation, as stated above.

Blood glucose monitoring

- Patients on an insulin pump should perform a minimum of 4 blood glucose tests per day.
    - A minimum of 4 tests per day may be performed in patients with satisfactory control.
    - In patients with less satisfactory control, 6 tests per day should be performed
    - An overnight test (e.g. 02:00) may be necessary.
    - Additional BGLs may be undertaken at any time by the patient.
    - Additional tests may be performed at the request of the Medical Officer or nursing / midwifery staff when clinically indicated.
    - The number of tests performed each day can only be reduced on the orders of the Medical Officer and can **NEVER** be reduced to less than 4 tests per day.

Device management

- The patient is responsible for ensuring the correct operation of the insulin pump.
- The patient will rotate the infusion set consistent with the recommendations for the device. This will be every three days, unless other documentation is provided.
- The patient will make the adjustments to the insulin pump's program.
- The patient will be responsible for all bolus dose administration.
- The insulin pump may need to be discontinued temporarily during a number of circumstances during hospitalisation. In this situation, discontinuation of the insulin pump for more than 30 minutes may result in significant hyperglycaemia.
- Such circumstances where the insulin pump needs to be temporarily disconnected includes:
    - Any radiological investigation (pump must be removed)
    - CT Scan (pump must be removed)
    - MRI scan (pump must be removed, including metal cannula)
    - Physiotherapy (depending on the therapy)
    - Hydrotherapy (if pump is not waterproof)
- Patients whose insulin pump needs to be discontinued for longer than 30 minutes may need to be considered for an injection of subcutaneous insulin, e.g. subcutaneous soluble insulin (Actrapid, Humulin R, Humalog, Novorapid or Apidra) to cover their short-term requirements.
- Patients needing to be regularly disconnected from their insulin pump should be considered for basal/bolus subcutaneous insulin injection therapy.

Operations and procedures

- The use of the CSII in operating theatres, procedure rooms etc is not contraindicated. Its use must be considered carefully in consultation between the anaesthetist, surgeon, physician, diabetes educator and patient.
- Potentially the insulin pump, by delivering stable and consistent insulin administration over hours can provide excellent peri-operative blood glucose control.
- In the basal infusion mode only, it can be considered “equivalent” to a very long acting insulin.
- As with all patients with diabetes undergoing surgery, patients who are unconscious need to be monitored carefully during and after their surgical procedure. Their blood glucose should be measured frequently while their conscious state is impaired.

Patients continuing on CSII peri-operatively

- The patient must consent to continuing on the insulin pump therapy peri-operatively.
- CSII and IV insulin should not run at the same time.
- The infusion site must be placed away from the operation site with consideration also given to where a diathermy pad may be placed. Ensure the insertion cannula is plastic, not metal. If the pump is to be used during surgery, the patient must replace metal cannulas with plastic insertion cannulas before any surgical procedures that may involve diathermy.
- An identification tag must be attached to the patient that states that the patient is using an insulin pump. This should be sited in a readily visible position appropriate to the procedure to be undertaken.
- The anaesthetist must have access to the insulin pump during surgery to enable it to be turned off or disconnected if necessary.
- The patients BGLs must be monitored every hour peri-operatively until they have satisfactorily regained consciousness and the patient is capable of making decisions regarding managing their insulin pump.
- In the event of the BGLs increasing to an unsatisfactory level peri-operatively, the diabetes physician on-call should be notified and switching to an IV insulin infusion should be considered.
- In the event of the BGL levels falling below 4mmol/L peri-operatively, the insulin pump must be turned and / or disconnected. Once euglycaemia is restored, CSII may be recommenced, either at a lower insulin infusion rate (if the medical staff are able to programme the device) or at a higher IV glucose infusion rate to prevent further episodes of hypoglycaemia. Alternatively, the

insulin pump may remain off and an IV insulin infusion commenced to control the patients BGLs.

- The use of CSII in major procedures should only be considered in rare circumstances due to the strong possibility that an adjustment to the patients' insulin therapy will be required during the prolonged peri-operative period. Discontinuation of the insulin pump and commencement of IV insulin therapy is recommended in this situation.

Patients not continuing on CSII peri-operatively

- Patients whose insulin pump is discontinued prior to surgery **will** require an intravenous (IV) insulin infusion.
- Discontinuation of the insulin pump even for short periods of time with no alternative source of insulin may result in the rapid development of hyperglycaemia and the patient should be carefully monitored.
- The CSII can be recommenced when (a) the patient has regained full consciousness and (b) it is considered medically appropriate.

Diabetes in pregnancy / obstetrics

Diagnostic criteria for GDM from 75g OGTT (WNHS recommendation)

The current ADIPS (Australasian Diabetes in Pregnancy Society) guidelines for the diagnosis of Gestational Diabetes Mellitus (GDM) on OGTT are a venous plasma glucose (PG) level of:

Fasting venous PG	≥ 5.1mmol/L
1-hour venous PG	≥ 10.0mmol/L
2-hour venous PG	≥ 8.5mmol/L

The diagnosis of GDM is made if one or more of the above values are abnormal.

Screening in pregnancy

Screening process

The diagnosis of diabetes in pregnancy will include those women with previously undiagnosed abnormalities of glucose tolerance, as well as women with glucose abnormalities related to the pregnancy alone.

Likely overt diabetes

Women with markedly elevated glucose levels during pregnancy (fasting > 7.0mmol/L or a random of > 11.1mmol/L (WHO guidelines) or an HbA1c > 6.5%) can be classified as having 'likely overt diabetes'. These women may have pre-existing diabetes mellitus (DM) and should be screened for diabetes complications.

A definitive diagnosis of non-gestational diabetes cannot be made until the post-partum period.

Risk factors

High risk factors for GDM

- Previous GDM
- Ethnicity: Asian (including Indian), Aboriginal, Pacific Islander, Maori, Middle Eastern, non-white African
- Maternal age ≥ 40 years
- Family history of DM (1st degree relative with DM including a sister with GDM)
- Obesity, especially if BMI > 35kg/m²
- Hypertension prior to 20 weeks

- Previous macrosomia (baby with birth weight more than 4000g)
- History of unexplained stillbirth
- Previous baby with congenital abnormalities
- Polycystic ovarian syndrome
- Medications: corticosteroids, antipsychotics

Any woman may be tested for diabetes at any time in pregnancy if there is clinical suspicion based on symptoms or other factors such as heavy glycosuria, fetal macrosomia or polyhydramnios.

High risk of GDM: Early Screening

- A standard 75g oral glucose tolerance test (OGTT) either before, or at the first opportunity after, conception.
- If this is not feasible, fasting or non-fasting venous plasma glucose (PG) should be performed

Low risk for GDM: Early screening if:

- Fasting plasma glucose: GDM diagnosed if ≥ 5.1mmol/L
- Non-fasting random plasma glucose. Proceed to an OGTT if ≥ 7.8mmol/L but <11.1 (diagnostic of gestational diabetes)

Repeat screening for GDM

If initial (early) screening is negative, then women at high risk of GDM should continue to be monitored closely and undergo a repeat OGTT (see recommendations for routine testing)

Routine testing for GDM

- All women not previously diagnosed with diabetes are recommended to have a standard 75g OGTT between 24 – 28 weeks gestation. Women to be directed to read the GDM information in the Pregnancy, Birth and Beyond book.

Pre-screening discussion / education

Procedure	Additional information
1. Explain to the women that the OGTT is a diagnostic test for GDM and the reasons for seeking GDM. 2. Obtain verbal consent for the test after giving the woman the following	The end points differ from those in the non-pregnant range.

information.

3.
   - Inform the woman:
   - She should eat normal CHO amounts for the 2 days prior to the test (not restrict CHO)
   - She should fast from midnight the night prior to the test (water is allowed).
   - The test involves three venepunctures and takes two hours to complete.
   - A fasting venous blood glucose sample will be obtained, and the result checked before proceeding.
   - She will be asked to consume a 75g glucose drink within 5 minutes – this may result in some nausea.
   - One hour and two hours after the 75g load, a venous blood sample is taken.
   - If the test is positive, she will be referred to the diabetes educators/ dietitian for an education session and will learn to monitor her BGL's at home.

   If the fasting result is ≥ 5.1mmol/L, the procedure is complete. No glucose load or further blood tests are required.

   This is the recommended glucose load used in pregnancy to diagnose gestational diabetes

   This test indicates the speed of the body's response to ingested glucose.

4. A laboratory request form signed by medical staff / Nurse Practitioner (NP) – Diabetes is required.

   Women may attend any laboratory for the test.

5. Women make their own appointment at the laboratory.

   The laboratory staff will then give instructions concerning arrival time. Refer to patient instruction sheet from the laboratory.

Screening for GDM after bariatric surgery

Dumping syndrome can occur after ingestion of refined sugars and high-glycaemic carbohydrates in patients who have had previous bariatric surgery. Symptoms include abdominal cramping, bloating, nausea, vomiting, and diarrhoea. Hyperinsulinemia and hypoglycaemia can occur later, resulting in tachycardia, palpitations, anxiety, and diaphoresis. Women with dumping syndrome may not tolerate the 75-g glucose solution typically administered to screen for gestational diabetes. Alternative screening methods, such as Fasting Plasma Glucose HbA1c or home glucose monitoring, should be considered in patients who have undergone restrictive/malabsorptive surgery.

When treating a pregnant patient who has undergone bariatric surgery, the clinician should conduct screening for diabetes during the first or early second trimester and again in the third trimester when HPL levels can influence glucose metabolism.

If it is confirmed that a patient has gestational diabetes, the patient or clinician should be referred to Diabetes Services where she will receive diabetes education and see a dietitian who is familiar with bariatric surgery.

Key points for doctors and midwives

- Ability to tolerate OGTT depends on surgery type and timing (see below)
- Early fasting plasma BGLs can help diagnose GDM early
- Additional growth scans should be requested if the fetus shows signs of being large for gestational age (LGA)

Can women have an OGTT after bariatric surgery?

Patients' ability to tolerate the test will depend on the type and timing of their bariatric surgery.

Type of Bariatric Surgery	Tolerance of the OGTT	
Lap Band	Most women tolerate the OGTT well	
Gastric Sleeve	Less than 12-18 months since surgery	OGTT may be poorly tolerated
	More than 12-18 months since surgery	OGTT normally well tolerated
Bypass surgery	Most women can NOT tolerate the OGTT	

Doctors at WNHS recommend the following for women with Bariatric Surgery who are unable to tolerate the OGTT:

Gestation	Test	Diagnosis
Booking visit (all women)	Fasting Plasma BGL	≥ 5.1 – Diagnostic of GDM
24-28/40 if previous FBGL was normal	Repeat Fasting Plasma BGL	≥ 5.1 – Diagnostic of GDM
At 28/40 if previous FBGL was normal	Loan a meter from Diabetes Service and monitor post-prandial BGLs for ~1 week	Diabetes Educator Midwives will review and diagnose GDM if indicated
If at any gestation after 28/40 baby is showing signs of being LGA, women will need an extra growth scan.	Random finger prick BGLs at clinics. PAGE Dietitian or Diabetes Educator Midwife if RBGLs are >6.7.	

For more information or advice, contact Diabetes Service on 6458 2163.

Referral to Diabetes Service

Referrals to the diabetes in pregnancy service are made via e-referral (preferred), or via fax on 6458 2164. If you need to speak to a diabetes educator call (08) 6458 2163.

A Medical Practitioner's referral is required for medical services.

Note: The referral should include results of all recent diabetes related tests if type 1 or type 2, and all antenatal blood tests and ultrasounds if currently pregnant.

Diabetes and Pregnancy Service provides:

All diabetes and pregnancy clinics involve a full multidisciplinary team approach to care

- Pre pregnancy counselling for women with Type 1 or Type 2 diabetes.
- Pregnancy care for women with Type 1, Type 2 diabetes
  - 2 x Diabetes antenatal clinics each week
- Shared antenatal care is available to women on consultation with the Diabetes Service and their General Practitioner (GP).
- Advice to health professionals regarding diabetes and pregnancy.
- Education:
  - Diabetes (Type 1, Type 2 or GDM) and pregnancy
  - Pre-conception care
  - Blood glucose meters
  - Insulin – ambulatory stabilisation
  - Continuous glucose monitoring
  - Insulin pumps
  - NDSS (National Diabetes Services Scheme) registration to obtain consumables

Education sessions

Key points

1. All women with Gestational Diabetes who are referred to the Diabetes Service are offered a gestational diabetes education class as soon as possible after diagnosis.
2. All women with pre-existing diabetes are offered a pregnancy and diabetes education class.
3. Diabetes education classes are culturally appropriate and adapted to meet individual needs. Interpreter classes are available for non -English speaking women.

Diabetes education

Education sessions are facilitated by a diabetes educator/ midwife and dietitian. Classes are available regularly each week. Extra sessions can be arranged as negotiated. Bookings are required.

All education sessions are shared jointly by the diabetes educator and dietitian:

Preconception sessions	
Type 1 / Type 2 diabetes 1 – 2 hour class depending on need	All by Appointment only
Type 1 / Type 2 diabetes in pregnancy clinics 1 – 2 hour class depending on need	

*All women are contacted and invited to attend a Diabetes and Pregnancy Class prior to attending the Pregnancy and Diabetes Clinic

GDM sessions	
GDM classes (2-hour class) **GDM – Non-English speaking (Interpreter) class** (2-hour class)	By appointment only via e-referral or Diabetes Midwife on: Ph (08) 6458 2163 Fax (08) 6458 2164

Class content- all classes

As classes are adapted to suit individuals- the content may vary. Education includes aspects of the following as appropriate

- What is diabetes? The types of diabetes
- Basic physiology - the role of food and insulin.
- The effects of diabetes on pregnancy.
- The effects of pregnancy on diabetes.
- The role of healthy eating in blood glucose control.
- The role of exercise in blood glucose control.
- Lifestyle changes.
- Postnatal issues.
- Advice regarding planning future pregnancy and contraception.
- Managing the psychological/ psychosocial aspects of coping with diabetes.
- Providing women access to equipment and supplies to effectively manage their diabetes.
- Self-monitoring blood glucose.

Gestational diabetes

In addition to the content for ‘all classes’ above:

- Breastfeeding and GDM
- Future risk of diabetes
- Self-insulin administration and insulin adjustment (if required)

Type 2 diabetes

Education includes aspects of the content for ‘all classes’ as appropriate PLUS:

- Insulin requirements in each trimester
- Long- and short-term complications of diabetes
- Review of type 2 medications in regard to suitability in pregnancy
- Insulin self -administration and insulin adjustment / equipment check

Type 1 diabetes

Education includes aspects of the content for ‘all classes’ as appropriate PLUS:

- Insulin requirements in each trimester
- Long- and short-term complications of diabetes
- Breast feeding and hypoglycaemia – insulin adjustment

Self-blood glucose monitoring: Current ADIPS recommended goals (obstetrics)

- Fasting <5.1mmol/L
- One hour post prandial <7.4 mmol/L
- Two hours post-prandial < 6.7 mmol/L

Diabetes (GDM and type 2) **not** requiring insulin or OHA

Management guidelines		Rationale
Education	• Refer to Diabetes Educator for instruction on diabetes, management plan, risk factors and blood glucose monitoring • Diabetes Service conducts education classes for women who plan to birth at WNHS	Ensures understanding of GDM and its implications and helps reduce anxiety. Will encourage adherence with treatment recommendations and BGL monitoring.
Diet	Refer to Dietitian. Recommend: • 5 – 6 low fat low GI meals/day • Snacks and supper are important • Ensure nutritional adequacy • Energy restricted diet for obese women (BMI >30).	Nutritional education is the main treatment strategy for BGL control. This is best received from a dietitian who is able to individualise nutritional requirements to maintain optimum BGLs
BGL	Aim for BGL of: < 5.1 mmol/L fasting level < 7.4 mmol/L 1 hour post prandial < 6.7mmol/L 2 hour postprandial	Strict control of BGLs significantly reduces rates of: • fetal anomalies and macrosomia • maternal hypo/ hyperglycaemia • neonatal hypoglycaemia
HbA_{1c}	Measure each trimester *****	The $HbA_{1}c$ level is a useful guide to the reliability of self-monitored BGLs
Exercise	Recommend 30 minutes of moderate exercise each day (e.g. swim / walk) provided no medical / obstetric contraindications	Exercise is a useful adjunct to dietary therapy in BGL control, maintaining general wellbeing and decreasing long-term complications
Fetal surveillance	Growth scan at 34 weeks	Further scans are not routinely ordered by the woman's team unless insulin commenced, fetal macrosomia.

*** HbA1c-** Women with GDM who are NOT going through the Diabetes Service for their antenatal care (i.e. GDM diagnosed after 22 weeks) do not need HbA1c done each trimester. When the woman attends the diabetes education class, the Diabetes Educator decides if a HbA1c is required depending on factors including her GTT result.

Diabetes **requiring** insulin or OHA

Management Guidelines		Rationale
Education	Refer to Diabetes Educator for instruction on diabetes, management plan, risk factors, blood glucose monitoring and insulin administration.	Ensures understanding of GDM and its implications and helps reduce anxiety. Will encourage compliance with treatment recommendations and BGL monitoring.
Diet	Refer to Dietitian. Recommend: • 5 – 6 low fat low GI meals/day • Snacks and supper are important • Ensure nutritional adequacy • Energy restricted diet for obese women (BMI >30).	Nutritional education is the main treatment strategy for BGL control. This is best received from a dietitian who is able to individualise nutritional requirements to maintain optimum BGLs.
BGL: GDM and Type 2 DM	Aim for BGL of: • <5.1 mmol/L fasting level. • <10.0 mmol/L 1 hour post prandial level • <6.7 mmol/L 2-hour postprandial level.	Control of BGLs significantly reduces rates of : • fetal anomalies and macrosomia • maternal hypo/ hyperglycaemia • neonatal hypoglycaemia
BGL: Type 1 DM	Aim for best control possible with each individual woman.	
HbA_{1c}	Measure at first visit and each trimester, women may benefit from extra tests.	The HbA_{1c} level is a useful guide to the reliability of self-monitored BGLs.
OHA's	In women resistant to large doses of insulin, OHA's may be considered, but such treatment remains experimental **and should be prescribed only by the Diabetes Physician.**	Experience with the use of selected OHA's in pregnancy is growing. OHA's are undergoing investigation in randomized control trials. For further information on safety of OHAs in pregnancy (or breastfeeding), contact WNHS Obstetric Medicines Information Service on 6458 2723
Exercise	Recommend 30 minutes of moderate exercise each day (e.g. swim / walk) provided no medical / obstetric contraindications.	Exercise is a useful adjunct to dietary therapy in BGL control, maintaining general wellbeing and decreasing long-term complications.
Insulin	Consult with Diabetes Physician or NP Diabetes if BGLs greater than goals.	Avoid fetal macrosomia and complications during the delivery.

Fetal surveillance	**Ultrasonography** • First Trimester Screen	11^{+6}–13^{+6} weeks	Includes gestational age, nuchal fold translucency and blood test: HCG, PAPP- A (10 – 13+6weeks) Blood test is sensitive if performed earlier rather than later approx. 2 weeks prior to USS
	• Anatomy	18-22 weeks	To assess whether structural anomalies are present.
	• Consider baseline growth scan	24 weeks	If history of pre-existing vascular or renal disease, hypertension, previous preeclampsia, thrombophilia or stillbirth
	• Serial USS for Growth, AFI, and umbilical artery Doppler	*****28, *****31, 34 and 36-37 weeks (***** Only in those women who have GDM diagnosis earlier than 26 weeks)	To detect irregularities in: • fetal growth • amniotic fluid index (e.g. polyhydramnios) Fetal AC measurement at 34 weeks is strongly correlated with birth weight.[1] Consider increased fetal 'wellbeing' scans if glycaemic control is poor or reduction in insulin requirements
	Cardiotocograph (CTG) After 34 weeks, consider 2-3 x week CTG if poor glycaemic control, reduction in insulin requirements, hypertension, renal disease, IUGR or fetal cardiomegaly		Commencement of CTG monitoring is determined by the degree of maternal vascular disease, renal involvement, glucose control and fetal growth on serial ultrasounds.
Betamethasone	The diabetes physician should be notified if steroids are considered necessary for enhancing fetal lung maturity. A BGL profile for 48-72 hours should be performed post steroids. BGL > 10mmol/L seek advice from the physician.		Significant changes in insulin requirements often follow Betamethasone administration. Insulin adjustment may be required from 6 hours post 1st dose until 48 hours after last dose.

Maternal surveillance	Ophthalmology Review (Pre-existing diabetes)	Review pre or early pregnancy to obtain a baseline and enable monitoring of the influence pregnancy has on the retina.
	Thyroid Function Test (TFT)	Women with diabetes are at a higher risk of abnormal thyroid function
	Spot urine – PC Ratio at booking, consider repeating if blood pressure elevated (PC Ratio- Protein: Creatinine ratio)	Review pre or early pregnancy to monitor the influence pregnancy has on the renal system and track any changes. This is also a predictor of pre-eclampsia.
	Baseline assessments of maternal vasculopathy	
	Insulin adjustment: The woman should have 1 - 2 weekly contact with a member of the team, by phone or in person.	This will assist in BGL control and enhance awareness for both the woman and the team members.
Mode of birth	Consider elective Caesarean Section if: • estimated fetal weight >4250g	To reduce the risk of shoulder dystocia
Timing of birth	Arrange an elective birth at 38-39 weeks for women requiring insulin or OHA's (or earlier as indicated by clinical situation)	To reduce the rate of fetal macrosomia and birth injury.

GDM: MGP / CMP management

Refer to the appendix for management specific to women receiving care in the Family Birth Centre Midwifery Group Practice (MGP) or Community Midwifery Program (CMP):

See Appendix I for GDM Management in the Family Birth Centre (FBC) Flowchart

Antenatal care / tests planner

Refer directly to form: "Pregnancy Care for Diabetes" (MR 223.98).

Inpatient: Admission procedure

Key points

1. During admission to hospital, all women with diabetes shall be referred to the Diabetes Service.
2. The Diabetes Educator / Midwife (page 3309) should be notified when women attend the Maternal Fetal Assessment Unit. Most attendances will be planned.
3. For unbooked attendances outside normal business hours (Monday –Friday 07:30- 16:00) please leave a message on the Diabetes Service answering machine extension 2163.

Admission procedure

On admission Nursing/Midwifery staff shall:

- If the woman has type 1 or type 2 Diabetes Mellitus, notify the:
  - Diabetes Educator / Midwife extension 2163 (leave a message after hours)
  - Dietitian page 3126 (during office hours)
- Commence relevant (obstetric or gynaecology) Diabetes Record MR 265. All women should check their BGLs pre breakfast and 2 hours post meals unless otherwise instructed (See section: Blood Glucose Monitoring)
- Women should use their own blood glucose meter and insulin equipment
- Ensure women have access to "snack cards" available from food services
- Inform the Diabetes Educator (pager 3309) if women require further diabetes supplies
- Ensure women on insulin have snack foods available in their room in case of hypoglycaemic episodes.
- In the event of a woman being unable to give her own insulin injections, staff should revert to using a vial, syringe and safety needle. Insulin pen devices are not to be used by staff due to increased finger stick injury risk.

Medication orders

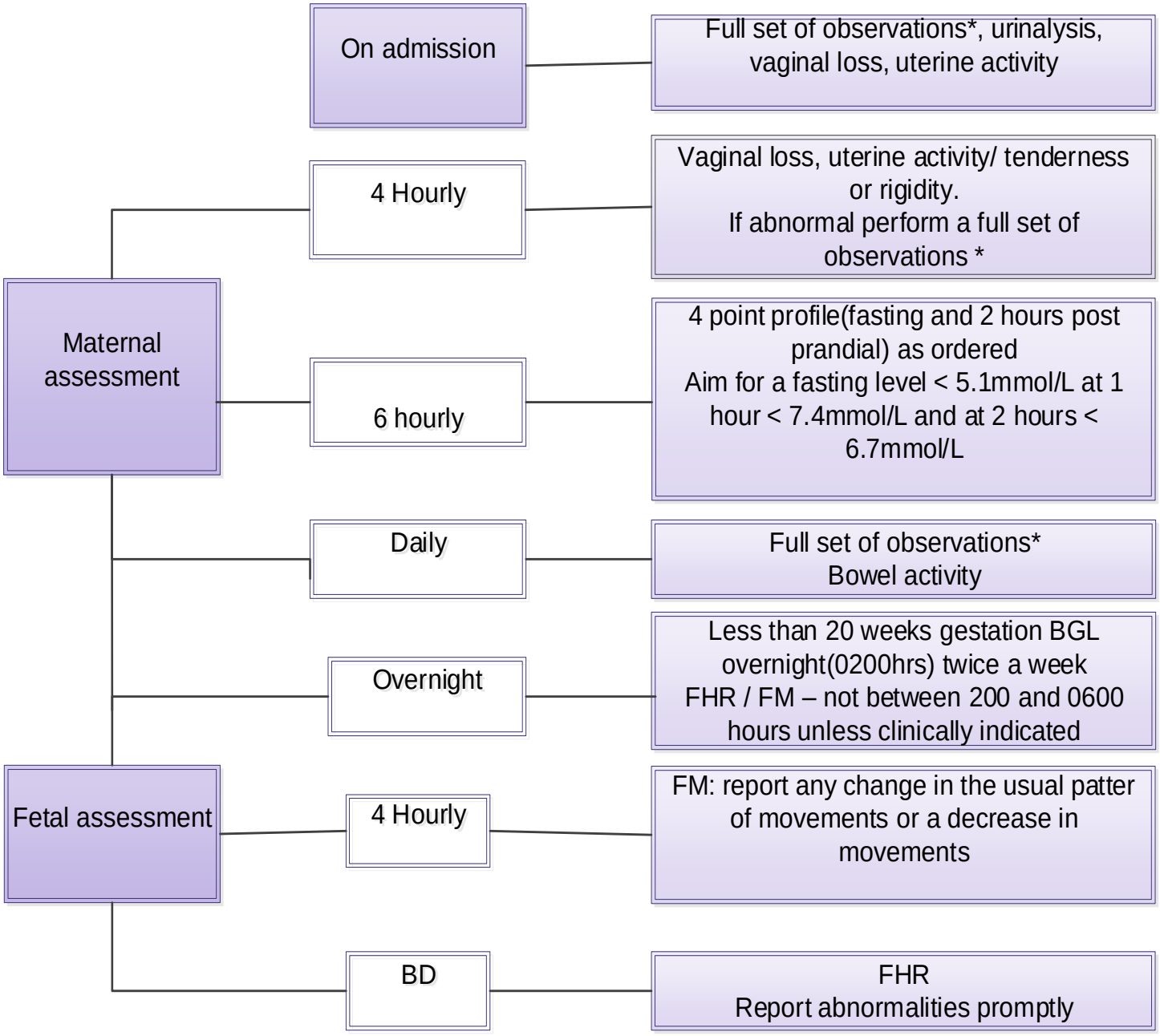
- On admission, continue the woman's usual home insulin or OHA regimen until:
  - review by the diabetes physicians / medical registrar / diabetes educator/or Gold Team Registrar
  - Call the Medical Registrar or diabetic educators if in doubt regarding insulin /OHA orders (during office hours) or the Physician on call if after hours
- Insulin orders are prescribed on the relevant (obstetric or gynaecology) Diabetes Record (MR 265).
- OHA doses are prescribed on the WA Hospital Medication chart (MR 810.05)

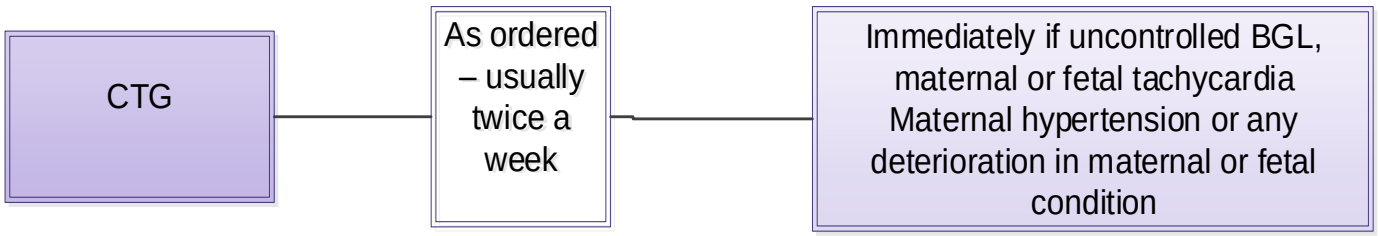
The insulin / OHA dose will be reviewed when:

- induction of labour (IOL) or caesarean section is planned (document the medication plan on the MR004 Obstetric Special Instructions Sheet)
- the woman is in labour
- the woman is admitted for induction
- the baby is born
- blood glucose results are out of target range on more than two occasions at the same time period.
- Changes in dose should be made in consultation with the woman by:
    - Medical Officer
    - Credentialed Diabetes Educator
    - NP Diabetes

For glycaemic management when receiving corticosteroids, refer to WNHS Clinical Guideline: Corticosteroids: Antenatal Use of

Inpatient: Antenatal care (midwifery) on the obstetric wards





Procedures to be considered

- Maternal laboratory investigations: HbA1C
- Corticosteroids (inform the Diabetes Physician before their administration)

Education

- Diabetes in pregnancy
- Plan of Care
- Preterm Birth
- Special care nursery
- Caesarean section
- Snack cards
- Diet 5-6 low fat/GI meals a day
- Breastfeeding and diabetes

Activity

- If maternal condition permits encourage ambulation
- Explain that exercise will increase glucose absorption

Documentation

- Check the diabetes management plan sticker
- MR 265 Diabetes Record
- MR 265.01 Insulin Infusion
- MR 004 Obstetric Special Instruction sheet
- MR 285.01 Maternal Observation hart
- MR 810 NIMC
- MR 250 Progress notes
- MR 410 Neonatal history sheet
- Baby notes prepared
- Perinatal database(STORK) updated

Referrals to be considered

- Activities co-ordinator
- Dietician
- Diabetes Educator
- Psychological Medicine
- Neonatologist
- Social Worker
- Aboriginal Liaison Officer
- Parent Educator
- Physiotherapist

Inpatient: Blood glucose monitoring and equipment

Aim

Women are provided with the knowledge and skills to be able to:

- Accurately monitor their BGLs at specified times
- State the goals of blood glucose management in pregnancy
- Respond appropriately when blood glucose results are abnormal
- Keep accurate records of BGL's

Key points

1. Routine monitoring of blood glucose is generally undertaken 3-4 days per week for women diet controlled and daily if women are on medication to control their BGL's.
2. Routine monitoring infers 4 daily readings – pre breakfast and 2 hours after the start of each main meal.
3. Staff shall:
    - Supervise at least one BGL performed by the woman, then encourage women to take control of their own blood glucose monitoring and keep record of results
    - Record all BGL's performed on - Diabetes Record MR 265 (in-patients)
    - Review the BGL results in the home monitoring diary each antenatal visit.
    - Respond appropriately by **notifying the Diabetes Physician / Registrar or Diabetes Educator/ Midwife if:**
        - prolonged episode/s of BGL out of range
        - the woman is unwell and BGL are elevated
        - administration of Celestone is planned

Inpatient care

Women with diabetes who are inpatients are reviewed daily Monday – Friday by the Diabetes service.

Equipment: Blood glucose meter – Access of supplies

Source of supplies for ward meters

Equipment	Supplied by
Optium Xceed Meter (Sensor) and Case	Diabetes Service
Optium Neo (H)* Blood Glucose Electrodes and Pack Insert (H)	Pharmacy
Optium Control Solution (Low and Hi in the one box)	Pharmacy
Logbooks, User manual, battery back covers	Diabetes Service
Lithium Batteries x 2	Supply
Lancets – one use only (hospital tender)	Supply
Gloves	Supply
Container for sharps disposal	Supply

NB: Patient's own Optium Xceed Meter and strips and the ward Optium Neo H Meter and strips are **not** interchangeable.

* The letter 'H' denotes that these electrodes are for hospital use only.

Do not give ward meter strips to patients to use in their own meter.

Inserting batteries

1. Slide battery cover from back of meter.
2. Insert 2 x lithium batteries (memory, time and date will be maintained if batteries are replaced as soon as low battery symbol is displayed).
3. Replace battery cover.
4. Wait 5 seconds and turn on meter.

Antenatal medication

Oral hypoglycaemic agents (OHA's)

Key points

1. Most OHA's are not currently recommended for use in pregnancy. Clinical trials are continuing to determine if there is any long-term effect on the fetus.
2. Oral hypoglycaemic agents are not generally used in type 1 DM. Oral hypoglycaemic agents may be prescribed by the physician for women with type 2 or gestational DM following discussion with the woman regarding

emerging data regarding possible long-term effects on the offspring in the following circumstances:

- Where the woman has been taking OHA's prior to and in early pregnancy (e.g. PCOS)
- Where the woman refuses to take insulin injections.
- When insulin compliance is poor.
- As a supplement to insulin or when large doses of insulin are required to control BGLs.

3. On admission notify the diabetes educators / medical registrar of women taking OHA's during pregnancy.
4. Blood glucose monitoring is essential throughout pregnancy – fasting and 1 or 2 hours post meals. If BGL's are not maintained within range subcutaneous insulin is offered.
5. Notify the diabetes physician / medical registrar of the woman's planned method for birth, for further instruction regarding OHA's in labour or prior to caesarean section.

Insulin therapy

Key points

1. Women with type 1 DM require insulin for life. Some type 1 women will be using a subcutaneous insulin pump for delivery of insulin.
2. Insulin pumps deliver a constant basal rate of short acting insulin and the woman will give a bolus dose for meals.
3. The woman will know how to manage her pump.
4. Frequent monitoring of BGLs pre and post meals is required for pump management
5. If diet and exercise has failed to achieve normoglycaemia in women with type 2 DM and GDM, diabetes medication is commenced.
6. Initiation of medication is discussed with the Diabetes Physician, NP Diabetes, or Obstetrician. Education is provided by a Diabetes Educator.
7. Women requiring insulin during pregnancy monitor their BGLs at least three days a week pre breakfast and 1 or 2 hours after meals to determine the effect of insulin doses on BGLs.

Commencing insulin therapy

- The need for and timing of insulin administration depends on the blood glucose profile as demonstrated by BGL monitoring and cannot be predicted by the OGTT result.
- Diet may be sufficient to achieve control after some meals, but not after others, depending on the individual's eating pattern and other life factors. For

example, insulin may be necessary only after breakfast, and not after other meals. In addition, insulin resistance increases progressively as pregnancy proceeds. For this reason, there is no final dose of insulin that will achieve control.

- Monitoring must be continued, and insulin dosage adjusted (usually increases two - three fold) as the pregnancy proceeds, determined by blood glucose response.

Timing and type of insulin

- When starting women on insulin the appropriate insulin to commence them on is determined by the time of day when glucose levels are high.

BGL elevated	Before breakfast	After breakfast	After lunch	After dinner
Start Insulin:	Nocte 2100-2130	Pre breakfast	Pre lunch	Pre-dinner
Type of insulin	Protaphane. Humulin NPH Lantus or Levemir	Short-acting e.g. Novorapid ®/ Humalog		

* Discuss with the patient a suitable time to take longer acting insulin with regards their normal sleeping habits, needs to be at a consistent time e.g. 2130 rather than “Before Bed”

Dose of insulin

- The key to the management of a pregnant woman requiring insulin is flexibility and providing the correct amount of insulin to maintain euglycaemia.
- When starting insulin, a SMALL DOSE IS PRESCRIBED by the medical officer, in anticipation that increasing insulin stepwise will be required to achieve blood glucose control as soon as possible.
- Women with diabetes mellitus who are inpatients are reviewed daily (Monday – Friday) by the medical registrar and/or diabetes educators and the physician on call should be notified of any problems out of hours or on weekends.
- Once discharged, the woman should maintain phone / email contact with the diabetes educators for assistance in determining subsequent changes to her insulin regimen on a least a weekly basis.

Intrapartum / postpartum: GDM (including planned IOL / caesarean)

Key points

1. Very few women with Gestational Diabetes Mellitus (GDM), **whether using insulin or not**, require insulin for labour or caesarean section.
2. All women with GDM for IOL or caesarean section who are on insulin or oral hypoglycaemic agents shall have the plan for their intrapartum and postpartum BGL and insulin dose management discussed and documented on the 'Diabetes Management in Labour and Postpartum' (white colour) sticker on the MR 004 'Obstetric Special Instructions Sheet' during antenatal clinic visits at 34 – 36weeks. This sticker is to be completed by the clinician (Obstetric team) seeing the patient at this visit.

Induction of labour or Caesarean section

GDM on treatment (insulin or oral hypoglycaemic agents)

- Measure BGL at usual times i.e. fasting and two hours post- prandial until fasting.
- **Guidelines for the management of GDM women using insulin or oral hypoglycaemic agents**
  - Bedtime insulin
    Insulin: Reduce nighttime long acting insulin by 50% - e.g. human isophane insulin (Protaphane or Humulin NPH) or insulin glargine (Lantus).
  - **Oral agents:** Do not give nighttime oral hypoglycaemic agents
- During induction of labour:
  - **Mealtime medication:**
    Continue normal mealtime short acting insulin (e.g. Novo Rapid) when eating meals until obstetrician determines fasting should commence.
  - **Check BGL at usual intervals i.e. fasting and two hours post prandial**
- With onset of fasting (labour or caesarean section)
  - For most women insulin is not required during labour or caesarean section.
  - If BGL exceeds 7.0 mmol/L start IV Glucose/insulin infusion regime- see section in this document: Intrapartum management of type 2 diabetes mellitus
  - If BGL falls below 4.0 mmol/L refer to Hypoglycaemia Management
  - Continue BGLs four - six hourly while in labour

GDM on diet only

- It is rare for women controlled by diet alone to require insulin in labour.

- If BGL exceeds 7.0 mmol/L inform the Diabetes Physician or Obstetric Medicine Registrar.

Post-partum management of GDM

- Women with GDM should not require insulin following delivery.
- If insulin has been required in labour or caesarean section, **discontinue insulin** following delivery of the placenta.
- Women with GDM who are treated with insulin or oral hypoglycaemic agents during pregnancy should complete a 24-hour BGL profile (fasting and 2 hours post each meal) prior to discharge. If results are 10.0 mmol/L or greater notify Diabetes Educator or on–call Physician (not necessary for women with GDM treated with diet / exercise only during pregnancy, unless otherwise requested).
- All women with GDM are advised to have an OGTT 6 – 8 weeks after the birth of the baby and this is repeated every 2 years at a minimum.
- Lifestyle changes are advised e.g. weight loss/maintenance, healthy diet, regular activity

Intrapartum / postpartum: Type 1 DM (including planned IOL/ Caesarean)

Key points

1. All women with TYPE 1 DIABETES require some basal insulin (analogue, pump or IV infusion) for labour or Caesarean section.
2. All women with TYPE 1 DIABETES for induction of labour or caesarean section shall have the plan for their intrapartum and postpartum management discussed and documented on the **MR 004** (Obstetric Special Instructions Sheet) during antenatal clinic visits at 34 – 36weeks. This sticker is to be completed by the obstetric physician team in the Diabetes service.

Induction of labour

- Measure BGL at usual times until fasting.
- **Evening prior**
  - **Mealtime treatment**
    Continue normal mealtime insulin and diet until obstetrician determines fasting should commence.
  - **Nighttime treatment**
    Insulin: Reduce nighttime insulin by 50% - usually insulin detemir (**Levemir**) or insulin glargine (**Lantus**) and less commonly humanised isophane insulin (**Protaphane or Humulin NPH**).
- **With onset of fasting**

- Commence IV Glucose/ insulin infusion according to protocol (see below) if BGL is greater than 7.0 mmol/l
- The physician must be notified if an insulin infusion is commenced

- **Continuous subcutaneous insulin infusion (CSII) pumps**
  - Women with their own insulin pumps are to be individually managed by the physician (see below).
  - The physician must be notified if a woman with an insulin pump is labouring.
  - In the event of unstable BGL's, inability of patient to self-manage the pump or uncertainty or unfamiliarity with pumps, consider early conversion to IV insulin/glucose infusion.

Elective caesarean section

- Ideally book the woman's Caesarean section first on the theatre list.
- **Evening prior**:
  - Measure BGL at usual times (fasting and 2 hours post meals) unless insulin infusion in progress.
- **Mealtime treatment**
  - Continue normal mealtime insulin and diet until fasting commences.
- **Nighttime treatment**

  Insulin: Reduce nighttime insulin by 50% - usually insulin detemir (**Levemir**) or insulin glargine (**Lantus**) and less commonly humanised isophane insulin (**Protaphane or Humulin NPH**) (See MR 004 Obstetric Special Instructions Sheet)

On admission

- **An IV cannula should be in situ once fasting commences in case of a hypoglycaemic episode during the overnight fast**.
- No insulin infusion is necessary unless BGL is above 7 mmol/L two hours post evening meal.
- If BGL is below 7 mmol/L, leave the woman to sleep unless hypoglycaemia is suspected and check BGL next at 0600 hours.
- If BGL greater than 7 mmol/L commence IV Glucose/ insulin infusion, as per INSULIN DOSE TITRATION on the 'Insulin Infusion Chart for Obstetric Women' MR265.01.
- If BGL is 5 to 7 mmol/L, repeat at 0600.
- For women admitted on the **day of surgery** check BGL on admission and if BGL greater than 7 mmol/L, contact physician on call for correction dose of insulin or to commence insulin/ glucose infusion, as in INSULIN DOSE TITRATION on the 'Insulin Infusion Chart for Obstetric Women' MR265.01.

Subcutaneous insulin pumps

Subcutaneous insulin pump use prior to and following caesarean section:

- Check BGL 2 hours prior to caesarean section and if < 5.0 mmol/L and

dropping***** the woman should SUSPEND pump insulin delivery and recheck the BGL in 30 minutes. *****Review glucose curve on continuous glucose sensor; if no sensor, repeat BGL in 30 minutes to ensure stability. Call the Physician if unsure. **NOTE:** If BGL >7.0 mmol/L **DO NOT SUSPEND** the pump. Check with on-call Physician regarding continuing management plan.

- Check BGL and repeat each 30 minutes.
- The woman should now set the pump basal rate to pre-pregnancy levels as already determined by the Physician (see MR 004 Obstetric Special Instructions Sheet).
- The woman should reconnect and restart the insulin pump once in theatre recovery area. Will need a new sensor and line if this has been removed (patient to supply).
- **NOTE:** If IV Glucose/insulin infusion has been commenced **DO NOT RESTART SUBCUTANEOUS INSULIN PUMP.** Continue to follow IV Glucose/ insulin infusion protocol. Notify Physician.

Insulin infusion set up

- Commence an **IV infusion of 10% glucose at 50mL / hour** via an infusion pump once IV insulin is required - see INSULIN DOSE TITRATION (Table 1) on the 'Insulin Infusion Chart for Obstetric Women' MR265.01.
- **Potassium Chloride (KCl) supplementation is generally not required but may be commenced at the medical staff's discretion**. Baseline serum potassium should be measured and rechecked if IV therapy continues for more than 12 hours or patient is vomiting.
- Commence **50 units of Actrapid® (short-acting) insulin in 50mL of 0.9% Normal Saline** (i.e. 1 unit per mL) via a 50mL syringe pump, if required – see INSULIN DOSE TITRATION (Table-1) on the 'Insulin Infusion Chart for Obstetric Women' MR265.01.
- Titrate insulin dosage to BGL as shown in Table 2 on the 'Insulin Infusion Chart for Obstetric Women' MR265.01.

NOTE: Before attaching the IV line, flush the line and then run through an extra 10mL of the insulin / saline solution through the length of tubing to saturate the insulin binding sites on the plastic tubing.

This guideline is intended to apply on the morning of induction / caesarean section. Please note: this protocol **SHOULD NOT be used in the event of a hyperglycaemic crisis** such as ketoacidosis, coma or hyperosmolar hyperglycaemic syndrome. **Instead, contact the on-call physician or Obstetric Medicine Registrar.**

Insulin dose titration

This guideline is intended to apply on the morning of induction / Caesarean section. See 'Insulin Infusion Chart for Obstetric Women' (MR265.01) for insulin infusion, commencement, titration and maintenance instructions.

Postpartum management of type 1 DM

On delivery of the placenta or soon after

- Decrease insulin infusion rate by 50% and continue as per INSULIN DOSE TITRATION (on the 'Insulin Infusion Chart for Obstetric Women' MR265.01) until subcutaneous insulin is commenced with the first meal post-partum.
- Continue with IV 10% glucose at 50 mL/hour until the first meal following the birth.
- Monitor BGL 2 hourly until subcutaneous insulin recommenced.

With the first meal i.e. full diet tolerated by the woman:

- Commence subcutaneous insulin as charted on the MR265. Contact the On-Call Diabetes Physician if this is not charted or documented on the MR004 (Obstetric Special Instructions Sheet).
- Maintain IV access for 4 hours.
- Return to 4-point BGL profile (fasting and 2 hours post each meal)

Ongoing management of diabetes mellitus

- Ongoing management for Women with type 1 DM should be with an Endocrinologist / Physician or Specialist Diabetes Team. Obstetric team RMO should confirm follow up arrangements prior to discharge.

Intrapartum / postpartum: Type 2 DM (including planned IOL / Caesarean)

Key points

- Women with diabetes to maintain blood glucose control (4 – 7 mmol/L) during labour/Caesarean section to avoid hypo / hyperglycaemia.
- Some women with TYPE 2 DIABETES may require insulin and glucose for labour or Caesarean section.
- All women with TYPE 2 DIABETES for IOL or Caesarean section who are on insulin or oral hypoglycaemic agents shall have the plan for their intrapartum and postpartum management discussed and documented on the MR 004 (Obstetric Special Instructions Sheet) during antenatal clinic visits at 34 – 36weeks. This sticker is usually completed by the obstetric team or the physicians in the Diabetes service.
- Measure BGL at usual times (pre-breakfast and 2hrs post meals) until fasting.

Evening prior to induction or caesarean section

- **Nighttime treatment**

  Insulin: Reduce nighttime insulin by 50% - usually insulin detemir (**Levemir**) or insulin glargine (**Lantus**) and less commonly humanised isophane insulin (**Protaphane or Humulin NPH**).

  Oral agents: Do not give nighttime oral hypoglycaemic agents

- **Mealtime blood glucose management treatment during induction of labour**

  Continue normal mealtime medication (insulin or OHAs) and diet until obstetrician determines fasting should commence.

- **With onset of fasting**

  Monitor BGL 2 hourly and if > 7.0mmol/L commence IV Glucose/ Insulin infusion according to Insulin Dose Titration protocol on the 'Insulin Infusion Chart for Obstetric Women' MR265.01.

Caesarean section

- Book the woman's Caesarean section first on the theatre list unless a Type 1 is also booked the same day (Type 1 women have priority)

Evening before:

- Insulin: Nighttime insulin is reduced by 50% - usually insulin detemir (**Levemir**) or insulin glargine (**Lantus**) and less commonly humanised isophane insulin (**Protaphane or Humulin NPH**) (See MR 004 Obstetric Special Instructions Sheet)
- Oral agents: Nighttime oral hypoglycaemic agents are withheld

On the morning of caesarean section:

- Check BGL on admission and if BGL greater than 7 mmol/L, commence IV Glucose/ insulin infusion, as per INSULIN DOSE TITRATION table 1 on the 'Insulin Infusion Chart for Obstetric Women' MR265.01

NOTE: Insulin infusion is not required for women with type 2 DM if BGLs are within normal range i.e. less than 7.0 mmol/L

Insulin dose titration

This guideline is intended to apply on the morning of Induction / Caesarean section.

See 'Insulin Infusion Chart for Obstetric Women' (MR265.01) for insulin infusion, commencement, titration and maintenance instructions.

Note: this protocol SHOULD NOT be used in the event of a hyperglycaemic crisis such as ketoacidosis, coma or hyperosmolar hyperglycaemic syndrome. **Instead, contact the on-call Physician or Obstetric Medicine Registrar.**

Postpartum management of type 2 DM

- If used during labour/ caesarean section, cease insulin/ glucose infusion at delivery of the placenta
- Check MR 004 for any ongoing medication orders
- Monitor BGL (fasting and 2 hours post each meal) for 24 hours, then as decided by Physician/ Diabetes Educator
- Contact Physician/ Diabetes Educator if BGLs are consistently above 10.0mmol/L.
- Women are referred back to their GP or Specialist Centre for ongoing management of their diabetes

Postnatal care / follow-up

Aims

- All women with Gestational Diabetes receive advice reinforcing lifestyle changes necessary to prevent/ delay the onset of future type 2 DM including weight loss / maintenance, healthy diet and regular activity.
- Women with Type 1 diabetes receive information to minimise the risk of hypo / hyperglycaemia occurring in the postpartum period.
- Women with Type 1 diabetes receive information regarding the possible change in insulin requirements with breastfeeding.
- Women with pre-existing diabetes have a summary letter sent to the Diabetes Physician or clinic of their choice and their GP. A new referral should be made if necessary.

GDM- postnatal care

- Most women with gestational diabetes revert to normoglycaemia at the time of the birth and do not require insulin in labour.
- If insulin has been required in labour, **discontinue** insulin immediately after birth.
- Check a random blood glucose the day after the birth.
- Women with GDM who are treated with insulin or oral hypoglycaemic agents during pregnancy should complete one 24-hour (4 point) BGL profile (fasting and 2 hours post each meal), prior to discharge.
- Cease blood glucose monitoring if BGL within normal range.
- Elevated BGL (above 10 mmol/L): contact the Medical Registrar / diabetes educator. After hours contact the Diabetes Consultant on call if BGLs are consistently elevated.
- It is recommended that women who have had GDM visit their GP for a follow up oral GTT at 6-12 weeks postpartum, and every 1-2 years thereafter[2]
- Lifestyle counselling is given (information over page).
- A summary letter is sent to the woman's GP for follow-up care.

Note: Less than 10% of women with GDM remain hyperglycaemic after the birth. The management of these women requires ongoing care from a diabetes or medical clinic in collaboration with their GP.

GDM lifestyle counselling

- Approximately 50% of women who have had gestational diabetes develop Type 2 diabetes mellitus later in life. Lifestyle counselling for the prevention of diabetes is therefore vital.
- Prior to discharge, all women with GDM should be offered information about:
  - Healthy eating patterns (small frequent low-fat meals and snacks)
  - Regular physical activity (30 minutes/day – moderate intensity)

- Weight control
- Contraception
- Long term follow-up
- Preconception counselling; future pregnancy

Type 1 diabetes- postnatal care

- Women with type 1 DM require insulin for life.
- Circulating insulin must be available at all times and the timing of ceasing an IV insulin infusion and commencing subcutaneous insulin is important to ensure sufficient circulating insulin.
- There is a dramatic decrease in insulin requirements postpartum, usually less than the pre pregnancy requirement.
- Review the instructions on the MR 004 (Obstetric Special Instructions Sheet) regarding commencing the insulin dose postpartum.
- Continue monitoring the BGLs. Type 1 women require more frequent testing. If the BGL is elevated > 10mmol/L or lowered < 4.0mmol/L contact the Diabetes Educator or Medical Registrar for review.

Continuous Subcutaneous Insulin Infusion (CSII) Pumps

- Women with their own insulin pumps are individually managed by the physician.
- Staff should know how to switch the pump off in case of severe hypoglycaemia.

Type 2 diabetes - postnatal care

- Postpartum there is usually a dramatic decrease in insulin needs.

  On delivery of the placenta:

  - Many women do not require insulin / OHA'S for some time after delivery – review instructions on MR 004 (Obstetric Special Instructions Sheet).
  - There is clear evidence that glibenclamide does not appear in breast milk in more than vestigial quantities, and metformin levels in milk are also very low. It is therefore reasonable to use these with breastfeeding if required.[3, 4]
  - Repeat 4-point BGL (fasting and 2 hours post meals for three meals). If elevated, (FBG > 5.5 or post meals >10), refer the woman to the Diabetes Educator or Medical Registrar for review.
  - Continue blood glucose monitoring, two to three days per week, in accordance with usual non-pregnant monitoring
  - Ensure the woman has a follow up appointment with her GP or Diabetes Specialist for further diabetes monitoring.

Contraception

- Pregnancy in a woman with diabetes has implications for the health of the woman and her baby.
- Unplanned pregnancy in a woman with diabetes with less than optimal diabetic control is accompanied by an increase in the risk of fetal abnormalities and other adverse events.
- Contraception must be discussed **before** the patient leaves hospital. This includes both reversible and permanent methods of contraception.
- Implanon is a suitable contraceptive for diabetic women.
- The combined oral contraceptive pill (OCP) is safe in diabetes. The progesterone only pill has a higher failure rate than the combined OCP and other long acting progesterone only contraceptives.
- The progesterone only pill is preferred to the combined OCP from 8 weeks postpartum. It does not affect lactation.[5]
- Women undergoing a second or further caesarean section must be counselled of the risks of further caesarean births.

Glucagon education (partners) – Type 1 diabetes

Aims

1. All women with type 1 diabetes shall be offered a Glucagon prescription and education if she presents in early pregnancy (4-24 weeks).
2. Pregnant women with type 1 diabetes require a support person who has been trained to effectively administer Glucagon (GlucaGen® hypo kit)

Reasons/causes of hypoglycaemic episodes	• Early pregnancy – 6 to 16 weeks gestation • Too much insulin • Skipping meals / insufficient carbohydrate • Morning sickness
Signs and symptoms of hypoglycaemia	• Partner to ask / identify what symptoms person usually feels • Discuss the signs seen when partner is “low”
“Do not’s” in hypo	If unconscious – do not force food or drink
Method	• Snap lid off vial • Inject sterile water from syringe into vial containing powder • Keep needle and syringe in vial and shake until powder dissolved • Draw up into syringe, expel air • Inject GlucaGen® into muscle
Sites for injection	INTRAMUSCULAR INJECTION: • upper arm, upper thigh, buttocks
Dose	Women require a full dose to be given = 1mg/ml (1i.u)
Action of GlucaGen®	Usually takes 10 to 15 minutes to respond.
If no response to GlucaGen®	• Phone for ambulance assistance • IV glucose is required
When returns to consciousness and able to swallow safely	• Give fast acting carbohydrate • List the types of food suitable • Reassure the woman
Side effects	Nausea/vomiting
Storage	• Room temperature <25^{O}C • Easily accessible location (out of reach of children) • Use immediately once prepared • Release tape when purchased for easy access in emergency
Supplies	Obtain prescription from GP Check expiry date regularly
Emergency numbers	• Ambulance service • Local hospital Emergency Department

Diabetes in gynaecology

Elective gynaecology surgery: Insulin for women with type 1 and type 2 DM

Preoperatively

1. Perform recent FBP, UEC, HbA1c, random BGL, ketones if BGL >10mmol/L and ECG.
2. HbA1c to be checked in all patients with diabetes.
    - If >9.0% consider deferral of elective surgery and referral to physician/endocrinologist/GP to improve glycaemic control.
3. Book the woman **first** on the morning theatre list on any normal working day. Inform the theatre staff of the woman's diabetes, type and management.
4. Notify the anaesthetist of the woman's:
    - type of diabetes
    - usual diabetes medication (insulin, oral hypoglycaemic agents)
    - blood glucose control i.e. HbA1c or random BGL
    - complications of diabetes.
5. Diabetes medication management pre-operatively should be as per the **WNHS Pharmacy Guidelines for Pre-operative Medication Management** (available via HealthPoint to WA Health employees)
6. On the morning of surgery:
    - Review the fasting blood glucose and ketone level.

    Type 2 diabetes (non-insulin dependent), if all BGL's are below 10mmol/L, generally insulin will not be needed whilst fasting.

    Type 1 diabetes, once fasting, women require IV access.
    - Patients with T1DM undergoing major surgery (> 2 hours and staying overnight) should have commencement of an insulin/glucose infusion considered, either in the preoperative or postoperative period at the discretion of the physician/anaesthetist. Their long acting insulin analogue should be continued in most cases.
    - Patients having minor surgery who have a fasting BGL >10 or have not received a long acting insulin analogue within the previous 24 hours should have an insulin/glucose infusion commenced.

Insulin / glucose infusion:

- IV infusion of 10% glucose at 40mL/ hour via an infusion pump (The IV glucose rate is not altered unless ordered).
- 50 units of Actrapid in 50mL of Sodium Chloride 0.9% via a syringe driver (i.e. 1 unit/mL). Titrate the insulin dosage to the BGL as per the variable rate insulin infusion (VRII) guideline on the Gynaecological Insulin Infusion Chart (MR265.02).

7. Check blood ketones in all patients who have a BGL >15
8. Women who manage diabetes with their own insulin pumps (CSII – Continuous Subcutaneous Insulin Infusion) should have an individual plan discussed and documented in conjunction with the physician.

Post-operative management

Consult the Physician on call if there are any problems.

Type 1 diabetes

- The woman should recommence her subcutaneous insulin therapy with the first meal (not snack) as ordered, similar to her pre-operative doses. The insulin/glucose infusion should be ceased ½ hour following the administration of subcutaneous insulin (**Never cease IV insulin without commencing subcutaneous insulin**).
- The woman's knowledge of self-insulin adjustment should be assessed, and if required education arranged.

Type 2 diabetes

- Once diet is resumed, if all BGL's are below 10mmol/L, monitor BGL's fasting and two hours post prandial (4-point profile).
- Continue the patient's regular oral hypoglycaemic agent regime once the patient has commenced eating.

Type 1 and Type 2 Diabetes

- A summary letter is sent to the Physician or Clinic previously caring for the woman or, a referral is made to the Diabetes or Medical Clinic at the woman's nearest hospital with a diabetes clinic.

Emergency gynaecology surgery: Insulin for women with type 1 and type 2 DM

1. Notify the anaesthetist of the woman's:
    - type of diabetes
    - usual diabetes medication (insulin, oral hypoglycaemic agents)
    - Blood glucose control i.e. random BGL +/- HbA1c if time permits
    - complications of diabetes

    Type 2 diabetes, if all BGLs are below 10mmol/L insulin may not be needed whilst fasting.

    Type 1 diabetes, once fasting, the woman will require IV access.
    - Patients with T1DM undergoing major surgery (> 2 hours and staying overnight) should have commencement of an insulin/glucose infusion considered, either in the preoperative or postoperative period at the discretion of the physician/anaesthetist. Their long acting insulin analogue should be continued in most cases.
2. Prior to surgery:
    - Obtain recent FBP, UEC, random BGL, ketones if BGL >10mmol/L and ECG
    - Diabetes medication management preoperatively should be as per the **WNHS Pharmacy Guidelines for Pre-operative Medication Management** (available via HealthPoint to WA Health employees)**.**
    - If fasting BGL >10, notify the Anaesthetist who may consider peri-operative insulin depending on other factors.
    - Check blood ketones in all patients who have a BGL >15
    - If requiring insulin/glucose infusion:
        - IV infusion of 10% glucose at 40mL/ hour via an infusion pump (The IV glucose rate is not altered unless ordered).
        - 50 units of Actrapid in 50mL of Sodium Chloride 0.9% via a syringe driver (i.e. 1 unit/mL). Titrate the insulin dosage to the BGL as per the variable rate insulin infusion (VRII) table on the Gynaecological Insulin Infusion Chart (MR265.02).

Abbreviations

AC	Abdominal circumference	K+	Potassium
ADIPS	Australasian Diabetes in Pregnancy Society	KCl	Potassium chloride
AFI	Amniotic fluid index	KEMH	King Edward Memorial Hospital
AMI	Acute myocardial infarction	LGA	Large for gestational age
ASCU	Adult Special Care Unit	MFM	Maternal Fetal Medicine
BD / b.d. / bd	Twice daily	MSU	Mid-stream urine
BGL	Blood glucose level	NDSS	National Diabetes Supply Scheme
BMI	Body mass index	NP	Nurse Practitioner
CGM	Continuous glucose monitoring	OCP	Oral contraceptive pill
CHO	Carbohydrate	OGTT / GTT	Oral glucose tolerance test
CSII	Continuous subcutaneous insulin infusion	OHA	Oral hypoglycaemic agents
CTG	Cardiotocography	OPH	Osborne Park Hospital
CXR	Chest X-ray	PAPP-A	Pregnancy associated plasma protein A
DKA	Diabetic ketoacidosis	PCOS	Polycystic Ovary Syndrome
DM	Diabetes mellitus	PG	Plasma glucose
ECG	Electrocardiogram	RBGL	Random blood glucose level
FBC	Family Birth Centre	RMO	Resident Medical Officer
FBG / FBGL	Fasting blood glucose level	T1DM	Type 1 diabetes mellitus
FBP	Full blood picture	T2DM	Type 2 diabetes mellitus
FH	Fetal heart	TFT	Thyroid function test
FHR	Fetal heart rate	UEC	Urea, electrolytes and creatinine
FM	Fetal movement	USS	Ultrasound scan
GDM	Gestational diabetes mellitus	UTI	Urinary tract infection
GP	General Practitioner	VRII	Variable rate insulin infusion
GI	Glycaemic index		
HbA1c	Glycated haemoglobin		
HCG	Human chorionic gonadotrophin		
HPL	Human placental lactogen		
ICU	Intensive care unit		
IM	Intramuscular		
IOL	Induction of labour		
IV	Intravenous		

References

1. Taylor R, et al. Clinical outcomes of pregnancy in women with Type 1 diabetes. **Obstetrics and Gynecology**. 2002;99:537-41.
2. Hoffman L, Nolan C, Wilson D, Oats J, Simmons D. The Australasian diabetes in pregnancy society consensus statement on gestational diabetes mellitus-management guidelines. **Medical Journal of Australia**. 1998;169:93-7.
3. Feig DS, Briggs, G G, Kraemer, J M, et al. Transfer of Glyburide and Glipizide into breast milk. **Diabetes Care**. 2005;28:8:1851-5.
4. Hale TW, Kristensen, J H, Hackett, L P, et al. Transfer of metformin into human milk. **Diabetologia**. 2002;45:1509-14.

Bibliography

Abbott Laboratories. 2006. Optimum Xceed User's Guide. Doncaster Victoria: Abbott Laboratories.

ACOG. Guidelines on Pregnancy After Bariatric Surgery. **American Family Physician**. 2010;81(7). Available from: http://www.aafp.org/afp/2010/0401/p905.html

ADIPS Consensus guidelines for the Testing and Diagnosis of Gestational Diabetes Mellitus in Australia.

Balsells M, Corcoy R, Adelantado JM, *et al*. 2000. Gestational diabetes mellitus: Metabolic control during labour. **Diabetes, Nutrition and Metabolism - Clinical and Experimental** 13(5):257– 62.

Bedalow A, Balasubramnyam A. Glucocorticoid-induced ketoacidosis in gestational diabetes: sequelae of the acute treatment of preterm labor. Diabetes Care 1997;20:922–4. 35.

Bell DS. 2001. Importance of postprandial glucose control. **Southern Medical Journal** 94:8:804-809.

De Veciana, M, Major, CA, Morgan, MA et al. 1995. Postprandial verses preprandial blood glucose monitoring in women with gestational diabetes mellitus requiring insulin therapy. **New England Journal of Medicine** 333:19: 1237-1241. (Level II).

Hagay ZJ, Weissman A, Laurie S, Insler V. Reversal of fetal distress following intensive treatment of maternal diabetic ketoacidosis. Am J Perinatol 1994;11:430–2.

Hod M, Jovanovic L, Di Renzo GC, et al. **Textbook of Diabetes and Pregnancy.** London: Martin Dunitz; 2003.

Jovanovic L, Knopp R, Brown Z, et al. 2001. Declining Insulin Requirement in the Late First Trimester of Diabetic Pregnancy. **Diabetes Care** 24:1130-1136. (Level IV).

Kitabchi AE, Umpierrez GE, Murphy MB, Kreisberg RA. Hyperglycemic crises in adult patients with diabetes: a consensus statement from the American Diabetes Association.

Kitzmiller J.L.: Diabetic ketoacidosis and pregnancy. Contemp Obstet Gynecol 1982; 20: pp. 141-147

Lagstrom J, Griffiths R. 2000. International consensus statements for diabetes education. **Diabetes in Pregnancy, Gestational Diabetes and Prepregnancy Counselling**:87-96.

Langer O, Conway DL. 2000. Level of Glycemia and Perinatal Outcome in Pregestational Diabetes. **Journal of Maternal-Fetal Medicine** 9:35-41.

Ling, JH, Hagerup, T and Campbell, RK. 1999. Lispro insulin: Absorption and stability in selected intravenous devices. **The Diabetes Educator** 25:2: 237-245.

Madaan M, Aggarwal K, Sharma R, Trivedi S. Diabetic ketoacidosis occurring with lower blood glucose levels in pregnancy: a report of two cases. J Reprod Med 2012;57:452–5.

Maislos M, Harman-Bohem I, Weitzman S. Diabetic ketoacidosis. A rare complication of gestational diabetes. Diabetes Care 1992;15: 968–70.

McElvy SS, Miodovnick M, Rosenn B, et al. 2000. A focused preconceptional and early pregnancy program in women with type 1 diabetes reduces perinatal mortality and malformation rates to general population levels. **The Journal of Maternal-Fetal Medicine** 9:14-20.

Murphy M, Whiteman D, Stone D, et al. 2000. Dietary folate and the prevalence of neural tube defects in the British Isles: the past two decades. **British Journal of Obstetrics and Gynaecology** 107:885-889.

Nankervis A; McIntyre d; Moses R; Ross GP; Callaway L; Porter C; Jeffries W; Boorman C; De Vries B for the Australasian Diabetes in Pregnancy Society; 2012.

National Collaborating Centre for Women's and Children's Health. 2008. Diabetes in pregnancy – management of diabetes and its complications from preconception to the postnatal period. **Nice Clinical Guidelines** 63.

National Diabetes Services Scheme (NDSS). CGM fact sheet. 2022.

National Institute for Health and Care Excellence. NICE Guideline. Diabetes in pregnancy: management of diabetes and its complications from preconception to the postnatal period. Published on 25 February 2015. Available from: nice.org.uk/guidance/ng3 [last accessed 18 Sept 2015]. 41. Kilvert JA, Nicholson HO, Wright AD.

Novo Nordisk. Consumer Product Information GlucaGen® Hypokit. Novo Nordisk. February 2015.

Rodgers BD, Rodgers DE. Clinical variables associated with diabetic ketoacidosis during pregnancy. J Reprod Med 1991;36: 449–51.

Schneider M, Umpierrez G, Ramsey R, et al. Pregnancy complicated by diabetic ketoacidosis: maternal and fetal outcomes. Diabetes Care 2003;26:958–9.

Suhonen L, Viilesmaa V, Teramo K. 2000. Glycaemic control during early pregnancy and fetal malformations in women with Type 1 diabetes mellitus. **Diabetologia** 43:79-82.

Related WNHS and CAHS policies, procedures and guidelines

WNHS Clinical Guidelines (available via HealthPoint to WA Health employees)

- **Anaesthetics:** Adult Resuscitation Drug Protocols: 50% Glucose
- **CAHS Neonatology:** Hypoglycaemia (neonate on postnatal wards) and Hypoglycaemia (in NICU)
- **Nutrition and Dietetics**: Dietary Management of Diabetes in Pregnancy
- **Obstetrics and Gynaecology**:
  - Antenatal Care Schedule
  - Corticosteroids: Antenatal Use of (glycaemic management when receiving corticosteroids)
  - Exclusion Criteria for Midwifery Group Practice Birthing in the Family Birth Centre
- **Pharmacy:**
  - Adult Medication Monographs: Insulin; Potassium Chloride
  - Insulin Storage and Handling
  - Pre-operative Medication Management

Useful resources (including related forms)

PathWest (consumer information)**:** Preparing for Your Test, including GTT

Forms

- MR 004 Obstetric Special Instructions Sheet
- MR 005 Gynaecology Special Instructions Sheet
- MR 223.98 Pregnancy Care for Diabetes (Type 1, Type 2 or GDM)
- MR 223.99 Diabetes in Pregnancy Assessment and Plan

- MR 224 Diabetes Antenatal Record
- MR 224.01 Insulin Adjustment Program- Diabetes Service
- MR 224.01a Insulin Adjustment Program continuation- Diabetes Service
- MR 265.01 Insulin Infusion Chart for Obstetric Women
- MR 265.02 Insulin Infusion Chart for Gynaecology Patients
- MR 265.03 Insulin Subcutaneous Order and Blood Glucose Record - Non-Obstetric
- MR 265.04 Subcutaneous Insulin Order and Blood Glucose Record – Obstetric
- MR 731 ASCU Observation Chart
- MR 740 Intravenous Fluid and Additive Order Form
- MR 810.05 WA Hospital Medication Chart

Keywords:	diabetes, pregnancy, education, type 1, type 2, GDM, NDSS, diabetes education, diabetes classes, blood glucose, blood sugar level, blood glucose monitoring, blood glucose test, BSL, BGL, abnormal blood glucose levels, monitoring blood glucose, recording blood glucose, blood glucose meter, diabetes service, hypoglycaemia, symptoms hypoglycaemia, treatment hypoglycaemia, ketoacidosis, DKA, OHA, insulin, diabetes educators, blood glucose monitoring, normoglycaemia, labour, induction, caesarean section, neonate, postnatal, Blood glucose meter, Optium Xceed, sensor, calibration, electrode, GDM after bariatric surgery, BMI, obese, emergency surgery, DM, insulin infusion, elective surgery, emergency surgery, gynae surgery, gynaecology, CGM, continuous glucose monitoring, diabetes mellitus, insulin infusion, gynaecology, gynae surgery		
Document owner:	Obstetrics and Gynaecology Directorate		
Author / Reviewer:	Diabetes Service / Anaesthetics		
Date first issued:	November 2019 (v1)	Version	3
Reviewed dates:	May 2021 (v2); Sept 2022	Next review date:	Sept 2025
Supersedes:	This Sept 2022 version (v3) supersedes the May 2021 version (v2) The May 2021 version (v2) supersedes the Nov 2019 version (v1)		
Endorsed by:	Obstetrics and Gynaecology Directorate Management Committee (conditional endorsement- once OOS resolution of ultrasound decision)	Date:	07/09/2022
Approved by:	Obstetric Consultant – Diabetes Service	Date:	28/09/2022
NSQHS Standards (v2) applicable:	☒ 1: Clinical Governance ☐ 2: Partnering with Consumers ☐ 3: Preventing and Controlling Healthcare Associated Infection ☒ 4: Medication Safety	☒ 5: Comprehensive Care ☐ 6: Communicating for Safety ☐ 7: Blood Management ☒ 8: Recognising and Responding to Acute Deterioration	

Printed or personally saved electronic copies of this document are considered uncontrolled. Access the current version from WNHS HealthPoint.

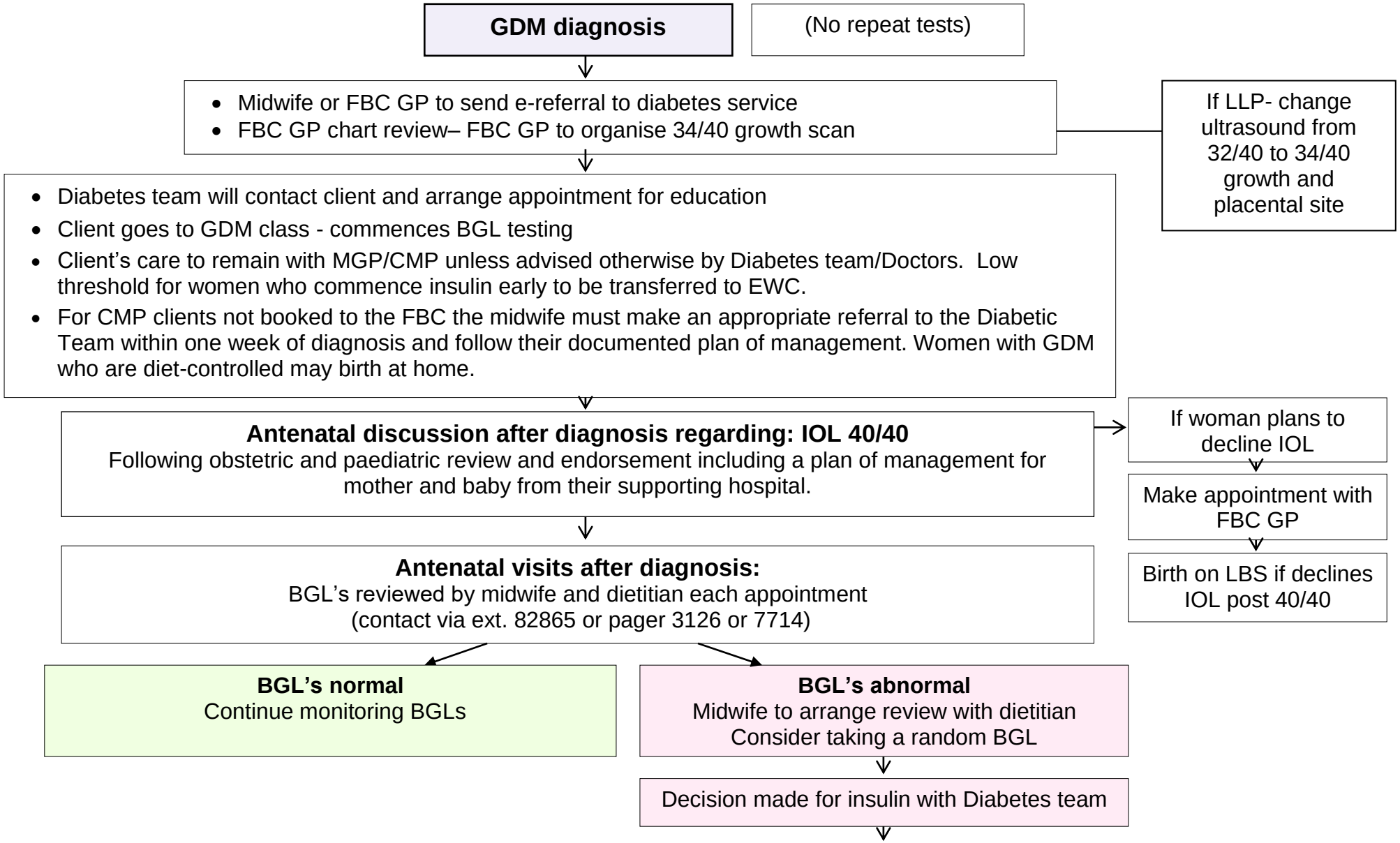
Version history

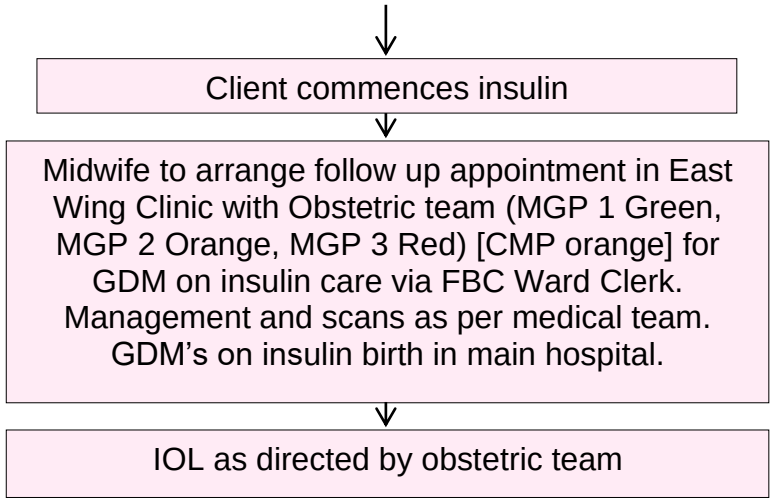
For a list of changes- see OGD Guideline Updates by month/year of review date

Version number	Date	Summary
1	Nov 2020	First version. In Nov 2019 merged Diabetes in Pregnancy with two Diabetes Gynaecology guidelines into one document and added CGM information. This version (v1.0) supersedes: 1. Diabetes in Pregnancy (dated April 2018) 2. Insulin Administration During & After Elective Gynaecological Surgery for Women with Type 1 and Type 2 Diabetes (dated August 2015) 3. Insulin Administration During & After Emergency Gynaecological Surgery for Women with Type 1 and Type 2 Diabetes (dated August 2015)
2	May 2021	• Hypoglycaemia section- ➢ If not on insulin or OHAs does not require treatment unless BGL <3.5mmol/l ➢ Sweet drink 100mL (as per updated insulin chart) • Insulin infusion pump- inpatient section- document doses in insulin to carbohydrate ratios and include this in the medical record and blood glucose monitoring form. Also document if any changes are required. • Referral to Diabetes Service via e-referral added • Diabetes in pregnancy: Requiring insulin or OHA section ➢ Fetal surveillance- serial USS section updated for women with GDM diagnosis before 26 weeks (scan changed to 31 weeks instead of 32 weeks) • Removed 'GDM Obstetric team clinic management' and 'GDM Nurse Practitioner clinic' chapters • Amended 'Intrapartum / postpartum: Type 1 DM (including planned IOL/ CS' chapter ➢ For women admitted on the day of surgery check BGL on admission and if BGL greater than 7 mmol/L, contact physician on call for correction dose of insulin or to commence insulin/ glucose infusion ➢ Instructions about subcutaneous insulin pumps changed: ▪ Check BGL 2 hours prior to caesarean and if < 5.0 mmol/L and dropping* the woman should SUSPEND pump insulin delivery and recheck BGL in 30 minutes. *Review glucose curve on continuous glucose sensor; if no sensor, repeat BGL in 30 minutes to ensure stability. Call the Physician if unsure. NOTE: If BGL >7.0 mmol/L DO NOT SUSPEND the pump. Check with on-call Physician regarding continuing management plan • Amended wording in GDM section for 4pt profile –now consistent with wording in other parts of guideline

3	Sept 2022	• Reminder in hypoglycaemia and DKA sections regarding code blue calling criteria – new alert boxes added **[RCA recommendation**] • Diabetes requiring insulin or OHA section: Mode of birth- removed HC-AC difference • Added about completing (at antenatal appointment) the 'Diabetes Management in Labour and Postpartum' (white colour) sticker • Abbreviations section added • Removed appendix with GDM low risk models of care planner document

Appendix I: GDM management for women birthing at the CMP/ FBC





EWC obstetric team appt. date
Red – Mon AM
Green – Tues AM
Orange – Wed AM

All clients with diet controlled GDM can birth in the FBC until 40 weeks gestation if the pregnancy is proceeding normally (BGLs well controlled with diet)

Postnatal

- Midwives to follow section in this document: Diabetes Postnatal Care/Follow up
- Women with GDM require a postnatal GTT

Important things to consider:

- GTT's that are close to normal can eventually lead to women requiring insulin.
- Beware of the woman's ethnicity. Incidence of diabetes is higher in women of Asian and Indian ethnicity, even for those with low BMI.
- Follow WNHS guidelines for early GTT for women with increased risk factors for GDM.