

Diabetes Mellitus: Management of Pre-Existing Diabetes Mellitus in Pregnancy



1. Purpose

This document outlines the details for management of pre-existing diabetes mellitus (DM) in pregnancy at the Women's.

2. Definitions

Type 1 diabetes mellitus (T1DM): absolute dependence on insulin.

Type 2 diabetes mellitus (T2DM): treatment options when not pregnant include diet, oral agents, insulin and non-insulin injectable agents.

3. Responsibilities

Staff providing the care for the management of pre-existing diabetes mellitus in pregnancy should familiarise themselves with this guideline.

4. Guideline

4.1 Pre-pregnancy counselling

- Pre-pregnancy care for women with type 1 or type 2 DM reduces adverse maternal and fetal outcomes in pregnancy¹.
- The Women's offers multidisciplinary pre-pregnancy care for women with pre-existing diabetes who are considering pregnancy.
- Women should be informed about and offered appropriate contraception if time is required to optimise diabetes management and control.

Specific diabetes related measures

- Glycaemic control should be optimised prior to conception. Target HbA1c levels are $\leq 7\%$ for T1DM and $\leq 6\%$ for T2DM.
- Elevated blood glucose levels at conception and early first trimester are associated with increased rates of miscarriage and fetal malformations²
- Higher HbA1c levels in early pregnancy are associated with higher rates of preeclampsia, preterm delivery and perinatal mortality².
- A full complication review should be undertaken.
 - Renal function and urine albumin: creatinine ratio.
 - Fundal photos or review by optometrist or ophthalmologist. Retinopathy requiring treatment should be addressed prior to pregnancy.
 - Assessment for gastroparesis and autonomic neuropathy.
 - Clinical screening for macrovascular disease and formal investigation if indicated.
 - TFTs, thyroid antibodies, coeliac disease screen for T1DM.
- Use of technology (pump therapy, continuous glucose monitoring, flash metre) should be discussed and facilitated as appropriate.

General pre-pregnancy measures

- Supplement folate intake: 2.5-5mg daily for at least one month prior to conception.
- Review medications (including complementary) for safety in pregnancy.

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- Facilitate smoking cessation if indicated.
- Optimise diet and weight.
- Encourage regular exercise: aim for 150 minutes (or more) of moderate activity each week.
- Limit alcohol intake.
- Check rubella and varicella immune status, and request other routine antenatal serology.
- Perform Pap smear, if not done within last 2 years; or last 5 years if new screening process.
- Organise FBE, blood group and antibodies.

Medications

- Metformin can be continued in women with type 2 DM or PCOS. All other oral hypoglycaemic agents and injectable GLP-1 agonists are contraindicated during pregnancy.
- Women with pre-existing T2DM treated with agents other than metformin or insulin should be stabilised on insulin and/or metformin prior to pregnancy.
- In special circumstances, oral agents (sulfonulureas) may be of more benefit than no therapy at all.
- Basal-bolus insulin is the preferred insulin regimen; pre-mixed insulin is occasionally used in T2DM. Insulin pump therapy or basal-bolus insulin is the preferred therapy for T1DM.
- Antihypertensive therapy should be optimised for pregnancy. ACE inhibitors and A2 receptor blockers are contraindicated in pregnancy and should be ceased. Evidence for target blood pressure for essential hypertension in women with diabetes pre-pregnancy is lacking. General non-pregnancy guidelines recommend a target of <130/80mmHg for patient with diabetes.
- Lipid lowering therapy must be ceased.

Education

- Formal review by a diabetes educator to discuss diabetes self-management, including:
 - hypoglycemia prevention and management, including glucagon use
 - insulin injection technique
 - pump skills review, including back-up plans for pump failure
 - blood glucose monitoring, flash monitoring, continuous glucose monitoring
 - sick day management (including ketoacidosis prevention and management in T1DM)
- Formal review with dietician, including carbohydrate counting education
- Optimisation of weight prior to pregnancy should be discussed and encouraged

Support and advice are available by contacting a diabetes educator or the Obstetric Medicine registrar during working hours, or the consultant on-call for diabetes after hours

Relative contraindications to pregnancy

The medical role is to counsel a woman with pre-existing diabetes about the risks of pregnancy in her specific context. The ultimate decision is made by the woman.

- Poor glycaemic control HbA1c > 7.0% until corrected. Glycaemic targets, however, must be individualised to achieve a safe balance between tight glycaemia and hypoglycaemia.
- Active proliferative retinopathy until treated.
- Severe nephropathy creatinine \geq 250 μ mol/L
- Macrovascular disease

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4.2 First Visit in Pregnancy

All women with pre-existing diabetes should be referred to and seen within the Diabetes Clinic. Exceptions are occasionally made for women with other high risk problems who must be seen within other clinics (such as fetal anomalies or multiple pregnancy) but should be discussed with the Head of Unit. Women with T1DM attending other clinics should continue to receive specialist diabetes care.

General pregnancy measures

- Request routine antenatal screening tests.
- Provide advice about treatment of nausea and vomiting in pregnancy.

Diabetes-related measures

Undertake steps as for pre-pregnancy counselling, if pre-pregnancy care has not been accessed.

- Glycaemic control
 - All women should perform self glucose monitoring (SBGM) at least 4 times each day: before breakfast, and before and/or 2 hours after each meal. Overnight testing should be performed according to clinical need.
 - Pre-prandial testing is recommended for patients on pump therapy or basal-bolus therapy.
 - BGL targets:

Type of diabetes	Fasting target	Pre-prandial target	Post prandial target
T1DM	4.5-5.5 mmol/L	5.0-6.0 mmol/L	<7.5mmol/L
T2DM	4.0-5.0 mmol/L	≤ 5.0 mmol/L	≤ 6.7 mmol/L

- Targets should be modified in women with recurrent hypoglycemia or hypoglycemia unawareness. Hypoglycaemia is more common during the first trimester, and hypoglycaemia symptoms can be altered, reduced or lost.
- Avoid BGLs <4.0mmol/L
- Insulin therapy will usually be basal-bolus with at least 1 dose of medium/long-acting insulin each day and short/rapid-acting insulin before each main meal; or insulin pump.
- Continuous or flash glucose monitoring has been shown to provide benefits in women with type 1 diabetes.⁵
- Women should be advised to undertake 30 minutes of exercise (e.g. brisk walking) at least 5 times per week unless medically contraindicated.
- All women with pre-existing diabetes should be reviewed by a dietician.
- HbA1c should be measured at the first visit and repeated 4-6 weekly. Pre-pregnancy HbA1c of 7% is equivalent to an HbA1c of 6.5% in the first trimester. The target level during pregnancy is <6.0%.
- Consider commencing 150mg of aspirin daily; this is indicated in most women with pre-existing DM

Screening for fetal anomalies/ aneuploidy

Screening for common chromosomal abnormalities should be discussed with all pregnant women. "Non-invasive prenatal screening" (NIPS) with cell-free fetal DNA is currently the test with greatest sensitivity and specificity and can be performed from 10 weeks' gestation. There is no Medicare rebate and out-of-pocket costs should be mentioned. An 11-14 week ultrasound for early morphology assessment, including nuchal translucency, is highly recommended.

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An alternative to NIPS is the first trimester combined screen (FTCS), which also has out-of-pocket costs but some Medicare reimbursement. Blood is drawn between 9 and 13 weeks (ideally 10) and an ultrasound for nuchal translucency performed between 11 and 14 weeks (ideally 12 weeks).

Both the NIPS and FTCS need to be organised through a GP, although the Women's will offer a 13-week ultrasound scan to high-risk women.

The mid-trimester serum screen is unreliable in women with pre-existing diabetes.

4.3 Subsequent Visits in Pregnancy

Frequency of visits

- Three-weekly until 28 weeks, then 2-weekly until 34-36 weeks, then weekly until delivery.
- Women should be seen at each visit by an obstetrician and a diabetes physician, as well as a dietician and diabetes educator as needed.
- Women should have an eye examination (fundal photos, optometrist or ophthalmologist) during the first trimester, and then as clinically indicated

Glycemic issues

- Hypoglycemia
 - Hypoglycemia has not been shown to increase rates of birth defects or fetal death.
 - Severe hypoglycemia can result in maternal illness or injury, which may have detrimental effects for both mother and fetus. Hypoglycemia therefore must be minimised
- Hyperglycemia
 - Stillbirth, and neonatal macrosomia, hypoglycemia and respiratory distress can be reduced with tight glycemic control.
 - In T1DM, diabetic ketoacidosis (DKA) occurs at lower glucose levels as pregnancy is a ketosis-prone state
 - DKA is an obstetric emergency with high rates of complications including fetal death.
 - Use of steroids (for any indication) may precipitate hyperglycemia and should be discussed with the endocrinology unit. Admission for monitoring is usually indicated; an IV insulin infusion may be warranted.
 - Corticosteroids for fetal reasons are not to be used in women with pre-existing diabetes after 37 weeks
- Admission
 - Pregnant women with hyperemesis, uncontrolled hyperglycemia +/- ketosis, or severe hypoglycemia may require inpatient admission for blood glucose stabilisation and further work-up and education

Fetal surveillance

- An ultrasound at 13 weeks for early morphology and nuchal translucency is highly desirable and will be offered by the Women's to high risk patients.
- Ultrasound examination for morphology at 19 -20 weeks' gestation is performed at the Women's.
- All women with pre-existing diabetes are currently offered a fetal echocardiogram at approximately 24 weeks.

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- Ultrasound examination for growth should be performed monthly at 28, 32 and 36 weeks. More frequent ultrasound examination, including relevant Doppler indices, may be indicated with the following complicating factors:
 - maternal microvascular (e.g. nephropathy or proliferative retinopathy) or macrovascular disease
 - hypertension, pre-existing or pregnancy-induced
 - fetal macrosomia
 - intrauterine growth restriction
 - poor glycaemic control
 - smokers
- Routine cardiotocography has not been shown to improve fetal outcomes but may be of use in high-risk patients.

4.4 Planning for delivery

Timing

- Women with optimal glycaemic control and no complicating factors (see above) should usually be delivered at around 38 weeks, with the method depending on obstetric factors.
- Women with T1DM and a suspicion of macrosomia should be delivered before 38 weeks, with a low threshold for caesarean section if the fetus is macrosomic.
- If delivery before 35 weeks is indicated, betamethasone to promote fetal lung maturity should be administered if possible. This will usually require admission for intensified diabetes management.
- If caesarean section is planned before 37 weeks, betamethasone is currently recommended as described in the [Antenatal Corticosteroids for the Prevention of Neonatal Morbidity & Mortality](#).

Mode of delivery

- If the estimated fetal weight on growth ultrasound is <90th centile, an attempt at vaginal delivery is usually appropriate unless there are other obstetric indications for caesarean section
- If the estimated fetal weight or abdominal circumference on growth ultrasound is >90th centile, the advantages and disadvantages of elective caesarean section need to be discussed, acknowledging that serious outcomes, such as shoulder dystocia and significant birth trauma, are often unpredictable
- If the estimated fetal weight or abdominal circumference on growth ultrasound is persistently >95th centile, elective caesarean section should be seriously considered, depending on other factors such as maternal BMI, parity and previous obstetric outcome.

4.5 Management of Delivery

Pre-induction

- A diabetes management plan is to be completed by an endocrinologist or obstetric medicine fellow. Usual or modified insulin doses are given prior to ARM, established labour or caesarean section.
- Usual insulin should be given while having prostaglandin or cervical balloon catheter.
- On the morning of ARM - fasting glucose level, light breakfast, adjust usual short-acting insulin according to fasting glucose level and breakfast.

Birth Centre

Oral food and fluids at discretion of the medical team.

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Blood glucose monitoring (BGM)

TARGET RANGE FOR BGLs DURING LABOUR IS 4-7 MMOL/L

- 2-hourly BGM
- Continue use of continuous glucose monitoring or flash monitoring if this is the women's usual practice; continue 2-hourly BGM.
- Intensify monitoring if symptomatic hypoglycaemia or BGL <4mmol/L; or BGL ≥7mmol/L
- If intensified monitoring required, contact obstetric medicine fellow or endocrinologist on-call.
- If vomiting, not drinking or prolonged labour, check ketone levels using blood ketostix.
- Contact obstetric medicine fellow or endocrinologist on-call if any concerns or at patient request.

Intravenous therapy

- Not routinely required for diabetes management
- Normal saline should be used if IV therapy is required;
- Caution with IV fluids if patient has significant oedema or pre-eclampsia.

Insulin

- Sliding scale - all 2-hourly.
- IV insulin infusion if required.

Low dose

For women receiving < 40 units/day antenatally (if alternative plan not in place)

Blood glucose level (mmol/L)	NovoRapid S/C (Humalog if patient using this already)
0-6	nil
6.1-8.0	2 units
8.1-10.0	4 units
10.1-14.0	6 units
≥7.0mmol/L	call RMO, obstetric medicine registrar or endocrinologist

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High dose

For women receiving > 40 units/day antenatally (if alternative plan not in place)

Blood glucose level (mmol/L)	NovoRapid S/C (Humalog if patient using this already)
0-6	nil
6.1-8.0	4 units
8.1-10.0	6 units
10.1-14.0	8 units
≥7.0mmol/L	10 units and call RMO

Intravenous insulin infusion

Suitable for patients requiring intensive therapy, for example pre-eclampsia, and/or elevated BGLs on a sliding scale. Consult with obstetric medicine fellow or endocrinologist.

- Via syringe pump: 50 units NovoRapid insulin in 50 mLs of Normal Saline
- **Start rate:** 1-2 units/hour depending on initial BGL: 1 unit/hour if BGL 7-9.9mmol/L; 2 units/hour if BGL ≥10mmol/L.
- If blood glucose level ≥7.0 mmol/l, increase insulin by 1 unit/hour
- If blood glucose level < 4 mmol/l, decrease insulin by 1 unit/hour
- If blood glucose level 4-7 mmol/L, maintain rate.

Note: Do NOT use this regimen for diabetic ketoacidosis.

Diabetic ketoacidosis is a medical emergency and requires multi-disciplinary input.

The obstetric medicine registrar or on-call endocrinologist must be involved promptly if this is suspected.

Management of hypoglycaemia

- Treat orally if possible
- Initial treatment: 15 grams simple carbohydrates (eg soft drink, juice, jelly beans).
- Repeat after 10 minutes if BG <4mmol/L.
- If BGL >4mmol/L, provide complex carbohydrates (eg sandwich, fruit, milk).
- If unable to eat comfortably, give 15 grams glucose gel.

If unconscious, administer 20ml 50% dextrose and contact the obstetric medicine registrar, on-call endocrinologist or anaesthetic registrar.

Elective caesarean section

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- Usual or modified insulin the night before caesarean section
- Book first on the theatre list in the morning
- Morning of caesarean section - withhold usual insulin if on multi-dose insulin
- Continue insulin pump therapy if on insulin pump. Ensure pump is sited away from the operative field and the pump cannula is non-metallic.
- Measure BGL in theatre prior to anaesthetic. Can use flash glucose measurement if available.
- Avoid IV dextrose unless hypoglycaemic
- Aim to maintain blood glucose levels in range 4.0-7.0mmol/L

4.6 Post partum management

Insulin requirements fall dramatically postpartum. Little or no insulin may be required for 24-36 hours. Monitor BGLs to avoid hypoglycaemia.

Blood glucose monitoring within 2 hours of birth then:

- Minimum 4x/daily and overnight : fasting, before each meal and 2am.
- Sliding scale insulin (very low dose). Regular review by obstetric medicine registrar, endocrinologist and Diabetes Clinical Nurse Consultant until discharge
- Women with T1DM should have a management plan in place prior to discharge.
- Women with T2DM will usually not require insulin in the postnatal period unless BGLs are consistently elevated

Breastfeeding

- Metformin can be used while breastfeeding, but other antihyperglycaemic agents must be avoided.
- Women should be advised about the possibility of hypoglycaemia while/shortly after breastfeeding. Quick-acting carbohydrates should always be within reach while breastfeeding.

Note: Refer to summary in Appendix below: [Women with Diabetes: Postnatal Management and Follow-up](#).

4.7 Neonatal Management

All well infants of mothers who have pre-existing diabetes (controlled by insulin, metformin or diet) should be transferred to the postnatal ward with their mother.

Refer to the guideline '[Hypoglycaemia, Infant Management](#)' for guidance on neonatal observations for babies of a woman with diabetes.

5. Evaluation, monitoring and reporting of compliance to this guideline

To be developed.

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6. References

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2. Jensen D, needs another two authors listed here as "et al", *et al.* Peri-conceptional A1C and Risk of Serious Adverse Pregnancy Outcome in 933 Women with Type 1 Diabetes. *Diabetes Care* 2009; 32: 1046-1048.
3. Butalia S,, Gutierrez ,, Lodha A., *et al.* Short and long-term outcomes of metformin compared with insulin alone in pregnancy: a systematic review and meta-analysis. *Diabet Med* 2017; ; 34: 27-36.
4. Feldman A, Brown F.. Management of Type 1 diabetes in Pregnancy. *Current Diabetes Rep* 2016; 16: 76.
5. Feig D, Donovan L, Conroy R, *et al.*. Continuous glucose monitoring in pregnant women with type 1 diabetes (CONCEPTT): a multicenter international randomized controlled trial. *Lancet* 2017; 390:2347-2359.

7. Legislation related to this guideline

Not applicable.

8. Appendices

[Appendix 1: Postnatal Management and Follow up](#)

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Postnatal Management and Follow up

	TYPE 1	TYPE 2
Insulin	<p>YES, reduced dose</p> <p>Sliding scale until resume usual regimen</p>	<p>May require on discharge if BGLs are elevated or on insulin before pregnancy</p>
<p>Monitoring of BGL</p> <p>Target levels post birth:</p> <ul style="list-style-type: none"> • pre breakfast: <ul style="list-style-type: none"> ○ <6mmol/L • pre-prandial: <ul style="list-style-type: none"> ○ 5.0-8.0mmol/L • 2 hr post-prandial <ul style="list-style-type: none"> ○ <10.0mmol/L 	<p>At least 4x/day and overnight</p> <p>Pre breakfast, pre-meals and 2am</p> <p>Obstetric Medicine Fellow to review</p>	
Follow-up in diabetes clinic	<p>YES in 6/52, booked by diabetes educator</p> <ul style="list-style-type: none"> • Endocrinologist (Diab Phys) 	

For further information or support

<p>Diabetes Educators:</p> <ul style="list-style-type: none"> • Monday – Friday 8am-4pm, ext 2153 • Lan Page 'Diabetes Educator' 52163 or via Switchboard
<p>Obstetric Medicine Fellow:</p> <ul style="list-style-type: none"> • Monday – Friday, 8.30am – 5pm <ul style="list-style-type: none"> ○ Lan Page 52157 or via Switchboard
<p>After hours separate...</p> <ul style="list-style-type: none"> • After hours: <p>Endocrinologist (on-call 24 hour) page via Switchboard</p>
<p>Dietitian:</p> <ul style="list-style-type: none"> • Mon-Fri, 8am- 4pm, ext 3160