Diabetes in Pregnancy

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1. Purpose of guideline

This guideline establishes the detection and management of diabetes in pregnancy at National Women's Health, Auckland District Health Board (ADHB).

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2. Guideline management principles and goals

The principles of this guideline are that pre-existing diabetes poses a high risk for pregnancy and that some pre-existing diabetes is undetected until pregnancy.

Gestational diabetes also increases risk for both pregnancy and future health. Therefore all pregnant women should be assessed for diabetes. Pre-pregnancy assessment should be offered where there is known pre-existing diabetes.

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3. Definitions

Diabetes in pregnancy covers a group of disorders associated with abnormal glucose metabolism either prior to pregnancy or during pregnancy. Before addressing these disorders it is useful to review normal glucose metabolism (see associated ADHB documents section for background paper: glucose metabolism).

Diabetes occurs when insulin production is deficient or inadequate (i.e. relatively deficient).

Diagnosis of diabetes outside pregnancy

The diagnosis of diabetes can be made outside pregnancy with a 75g oral glucose tolerance test (OGTT), although this has been replaced outside pregnancy in NZ with HbA1c testing (see below).

Diabetes is present if the fasting plasma glucose is 7.0mmol/l or higher or a two hour post load glucose is 11.1mmol/l or higher.

The American Diabetes Association has stated that diabetes can be diagnosed in a person who has an HbA1c of 48mmol/mol or above. In New Zealand, a cut off of 50 mmol/mol or above is used to diagnose diabetes outside pregnancy. There are several types of diabetes and it is important to know the correct diagnosis, as this does affect management (see associated ADHB documents section for background paper: types of diabetes).

Prediabetes: Impaired glucose tolerance and impaired fasting glucose outside pregnancy

- IGT is defined as OGTT 2 hour 7.8 – 11.0mmol/l
- IFG is defined as fasting glucose 6.1 – 6.9mmol/l (or 5.6 – 6.9mmol/l in the USA)

In New Zealand, an HbA1c of 41-49 mmol/mol is used to diagnose prediabetes outside pregnancy (see associated ADHB documents section for background paper: impaired glucose tolerance).

Definition of gestational diabetes mellitus (GDM)

Gestational diabetes mellitus is defined as abnormal glucose tolerance that is detected or develops in pregnancy.

Current New Zealand diagnostic criteria for GDM:

- OGTT fasting ≥ 5.5mmol/l or 2 hour glucose ≥ 9.0mmol/l

In the majority of cases, GDM is diagnosed after 20 weeks' gestation and will be 'new onset' diabetes that has developed during pregnancy secondary to acquired insulin resistance. It is recognised that some women with GDM may have previously unrecognised type 2 diabetes or prediabetes or rarely type 1. If a woman with GDM has an HbA1c of 50 mmol/mol at diagnosis in pregnancy, they can be referred to as

probable unrecognised diabetes during the pregnancy. This is a useful term to alert clinicians that this is a higher risk subgroup of women with GDM. Other women may be reclassified with prediabetes or diabetes when they have postpartum follow up screening.

It is important to remember that women with GDM are therefore a heterogeneous population. The pregnancy risks therefore vary widely within this group of women and some can be very high risk (see associated ADHB documents section for background paper: why we look for GDM – a history lesson).

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4. Pre-pregnancy assessment – women with known diabetes

The aims of pre-pregnancy counselling are to assess the woman's control, identify complications and explain pregnancy risks.

All women with pre-existing diabetes should be offered pre-pregnancy counselling. Doctors caring for women with diabetes should ensure they are aware of the importance of this. In the USA < 20% women with type 1 have pre-pregnancy counselling. In Auckland, where type 2 diabetes is more prevalent, < 10% of women with type 2 diabetes come for pre-pregnancy counselling. All women of childbearing years who have diabetes should have contraception discussed regularly (see associated ADHB documents section for background paper and links to patient pre-pregnancy information).

Also see checklist for investigations for planning/during pregnancy section below.

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5. Screening and diagnostic testing in pregnancy - for women who do not have known diabetes

It is recommended that women are screened for previously unrecognised diabetes/prediabetes by requesting an HbA1c with their first antenatal bloods. This has been recommended in high risk women at National Women's Health (see flow diagram) but this may change in 2014 to recommending it in all pregnant women.

If the HbA1c result is above the non pregnancy reference range (if > 40mmol/mol) women should be referred to the diabetes in pregnancy service.

All women who have a normal HbA1c should be offered screening for GDM at 24 - 28 weeks gestation (see flow diagram).

If a woman is obese or has other significant risk factors, she may not require a 50g screening test, but may go straight to a diagnostic 75g OGTT.
At National Women's Health, women with a BMI of 31 - 35 kg/m² have a 20% risk of GDM, and if BMI is > 35 kg/m², it is 27% (annual report 2011). Women over 40 years of age have 20% risk of GDM. Pacific, Indian and Asian women have 16 - 22% risk of GDM. It seems sensible to offer 75g OGTT as first option at 24-28 weeks for these women.

Currently, ADHB's diagnostic criteria remain unchanged: refer if fasting glucose ≥ 5.5mmol/l or the 2 hour glucose is ≥ 9.0mmol/l.

If a higher risk woman does not wish to perform an OGTT as the initial test, or she is perceived to be lower risk, the woman can be asked to do a 50g glucose screen (non fasting, with glucose measured one hour after 50g glucose load).

- Refer if 1 hour glucose ≥ 11.1mmol/l
- Recommend OGTT if 1 hour glucose ≥ 7.8mmol/l
- If the result is between 7.2 - 7.7mmol/l consider doing OGTT if other risk factors present

If GDM has not been diagnosed but is suspected, a further 75g OGTT at 32 weeks should be considered. If there is high clinical suspicion of GDM and the woman's results are not diagnostic, discuss the woman with the diabetes in pregnancy service.

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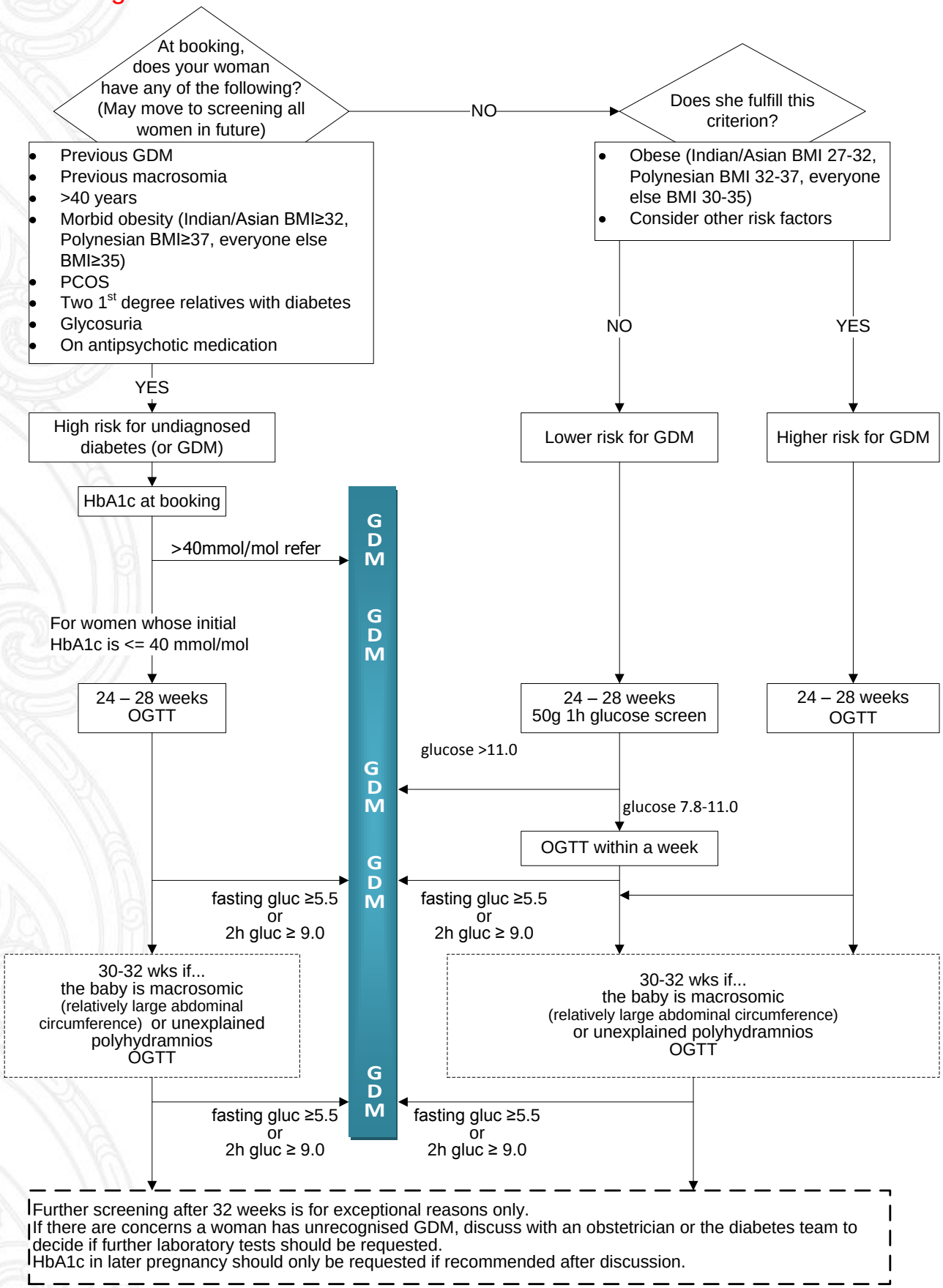
a) Screening for diabetes/GDM



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b) What to do at the booking visit to educate women about GDM

See associated ADHB documents section for the CR2949: Maternity Diabetes Service Referral and for background paper: future screening recommendations).

- Discuss healthy diet, exercise, appropriate weight gain
- Inform the woman about diabetes in pregnancy. If agreeable, request HbA1c with booking bloods
- If HbA1c elevated, refer to the diabetes service
- If HbA1c within normal range, discuss importance of further testing for GDM between 24 - 28 weeks
- When the woman is seen between 24 - 28 weeks, give her a laboratory form to test for GDM before her visit at 28 weeks
- Routine antenatal bloods can be performed at the same time

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6. Checklist for investigations for planning/during pregnancy for women with diabetes

Pre-pregnancy

- HbA1c: every 3 months
- Fasting lipids: baseline and only repeat if requested by physician
- Serum creatinine: baseline and 3 monthly if abnormal
- Baseline LFTs: baseline and 3 - 6 monthly if abnormal
- FBC and ferritin: follow up if treatment required
- TFTs: T4 and TSH (note that an isolated low T4 may relate to iodine deficiency)
- For vegetarians and Indian women or bowel disorders also check B12
- Booking bloods – and include HIV if agreed to
- Thyroid antibodies for type 1: every 2 years if negative. If positive, no need repeat
- Coeliac screen for type 1: every 2 - 5 years if negative. If positive, requires referral for endoscopy and biopsy to confirm diagnosis
- Check re recent smear or if need to do swab
- MSU for infection, cells etc as screen
- Urine ACR or if proteinuria, consider if needs baseline 24 hour urine protein and creatinine clearance: check with physician frequency of repeat
- If renal impairment, also check potassium, calcium, phosphate, albumin and urea
- Chase last eye review

- ECG to be considered if has had diabetes for > 10 years (discuss), age > 40/45, younger age if other risk factors such as smoking, plus obesity, plus family history. Note: Vitamin D measurements are unable to be requested routinely, because of cost, but deficiency should be considered especially in women with coeliac, very pale skin, no sun exposure, and women with darker pigmented (include all Indian women, as very high rates of vitamin D deficiency). Vitamin D supplements are recommended in high risk women, at least for pregnancy and lactation (see associated ADHB documents for link to Vitamin D deficiency letter).

Pregnancy – presenting in first trimester

- If they have not been for pre-pregnancy counselling, do list above
- If no underlying concerns and glucose monitoring is adequate and accurate, bloods may not be needed until after the first trimester until about 20 weeks
- Recheck HbA1c then and ask the physician what else should be followed (e.g. if renal impairment, monthly renal tests)

28 weeks

- Routine antenatal bloods
- HbA1c
- Urate as baseline
- Creatinine if required
- Ferritin
- See if needs follow up of other abnormal tests e.g. LFTs etc

36 weeks

- As 28 weeks, but ferritin only if indicated
- Additional lab tests as requested or planned at first antenatal visit

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7. Management in early pregnancy

Women with diabetes should be under specialist care and are usually looked after in a clinic where there is access to an obstetrician, physician, midwife diabetes educator and dietitian.

Known diabetes and previously unrecognised diabetes

- Accurate assessment of gestation: LMP, early US scan
- Anatomy scan at tertiary centre (or equivalent) at 19 - 20 weeks
- Fetal ECHO at 22 - 24 weeks if any concern about cardiac anatomy (not done routinely in Auckland, but some centres do)
- Careful control of diabetes (also see below). Typically, insulin requirements increase, especially overnight in early pregnancy, but between 9 - 13 weeks' requirements often decreases, as women are more insulin sensitive and hypoglycaemia can be a problem. If vomiting is a problem, women can take their short-acting insulin analogue 10 - 30 minutes after the start of a meal, as a temporary measure (and go back to taking it before they eat as soon as possible). Hypoglycaemic unawareness may occur with tighter glycemic control. Ensure women know about driving and hypoglycaemia (in general 5 before they drive and not to drive within 45 minutes of treating a hypo; ensure glucagon not expired, medicalert bracelet)
- Women are usually seen every 3 - 4 weeks and liaise closely with diabetes educators/diabetes midwives between visits
- Consider whether to recommend low dose aspirin for preeclampsia prevention, and also whether to recommend calcium
- If they have not been seen pre-pregnancy, go through the pre-pregnancy investigations checklist to ensure other screening up to date e.g. eye review. Let the eye screening clinic know the woman is pregnant

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8. Management in later pregnancy

From 16 - 20 weeks, women usually become more insulin resistant. Women on insulin should be encouraged to increase their insulin doses adequately, especially their mealtime boluses, which typically increase more than the basal insulin (often end up with 2/3 insulin as bolus, 1/3 basal). Many women fall behind with their treatment between 20 - 28 weeks' gestation.

In general, organise a fetal growth scan at 28 and 36 weeks gestation plus others as indicated for obstetric concerns:

- Include HbA1c at 28 and 36 weeks with routine bloods (may do at 16 - 20 weeks as well as early pregnancy in pre-existing diabetes). Consider other lab tests of relevance such as creatinine or urate or liver function, ferritin etc
- See in clinic 2 - 3 weekly from about 28 weeks, or earlier if concerns about blood pressure, fetal growth, diabetes control etc, then weekly from 34 - 36 weeks
- Consider timing and mode of delivery
- Monitor for complications

Complications are likely to be a result of an altered intrauterine environment. Firstly, increased glucose and other nutrients are delivered to the fetus, unless very tight control is maintained. Secondly, there are a number of alterations in the placenta in response to poorly controlled diabetes that can lead to a reduction in uteroplacental blood flow. Women with vascular complications are likely to have further changes occurring in the placenta which may account for some of their increased risks already outlined.

The fetus responds to an increased glucose load from the mother by increasing its own insulin levels to maintain euglycemia. Fetal hyperinsulinemia typically results in increased growth of the fetus, with increased deposition of fat in the liver and body and increased oxygen consumption. These changes lead to an increased susceptibility of the fetus to become hypoxic. When there is abnormal placentation, however, there may be fetal growth restriction.

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9. Glucose control in pregnancy

In National Women's Health, women with type 2 diabetes and GDM check their capillary glucose levels fasting and 2 hours after meals (from the start of the meal) each day (i.e. 4 tests per day). Women with type 1 diabetes usually test before each meal as well as after, and during the night as requested, particularly those on a pump, where overnight basal rates may be changed more than once a week during some stages of pregnancy. Sometimes, women with GDM or type 2 diabetes are asked to do additional pre-meal tests, particularly if concerned about snack size.

Glucose targets

Glucose targets are: average fasting < 5.0mmol/l and average 2 hour postprandial < 6.0 mmol/l (aim always<6.5mmol/l), based on data showing better pregnancy outcomes when these levels are achieved (Rowan et al Diab Care 2010; 33:9-16, see supporting evidence section). If testing one hour after eating, the target is average <7.0mmol/l (aim always <7.5mmol/l). These glucose thresholds also equate to one standard deviation above the mean for normal pregnancy glucose levels. In women with type 1 diabetes it is very difficult to achieve these targets.
Good control is achieved by paying attention to all aspects of lifestyle, plus medication may be required.

Diet

Diet is the cornerstone of treatment and appropriate intake should be guided by the dietitian. In type 2 and GDM, obesity is usually an issue. Calorific restriction improves insulin sensitivity and control but it results in lipid utilisation for energy and associated ketone formation. There are uncertainties as to whether ketonaemia in pregnancy is associated with adverse effects on subsequent neuropsychological development of offspring and at present the aim is to avoid significant ketosis. A study looking at 50% reduction in calories in obese women with gestational diabetes showed marked improvement in glycemia and reduction of hyperinsulinemia but marked ketosis. A 30% reduction showed some improvement without such ketosis and this may be a reasonable level to aim for with close dietary supervision. Overall, dietary composition is usually recommended as 20% protein, <10% saturated fat, <10% polyunsaturated fat and the remaining 60-70% as monounsaturated fat and carbohydrate. It is recommended that obese women have at least 1700cal/day and at least 170g of carbohydrate/day. The calorie requirement increases in women with a lower BMI to maintain adequate weight gain.

Exercise

Exercise is another cornerstone of therapy for type 2 diabetes and GDM. Strenuous exercise may be associated with fetal bradycardia and IUGR. Less strenuous exercise, such as walking and swimming and upper body exercises, seems to be safe and effective in improving insulin sensitivity. In women with type 1 diabetes, they may require further education about adjusting insulin doses around exercise. Usual recommendation is 30 minutes of exercise 5 or more days/week.

Insulin

All women with type 1 diabetes should continue on insulin during their pregnancy. The few women with type 2 diabetes who do not require insulin in early pregnancy are usually on insulin by the second half of pregnancy. About 30 - 70% of women with GDM in different centres require medication to maintain glycemic control and insulin or oral agents can be considered (see below). Fetal abdominal growth is also considered in the decision to start medication in women with GDM in a number of centres, aiming for more aggressive glucose lowering if the fetus is becoming macrosomic.

Other treatment options in women with GDM (and type 2)

Metformin

A prospective randomised trial (MiG) comparing metformin with insulin treatment in women with GDM reported similar neonatal and other pregnancy outcomes in each treatment arm (Rowan et al. NEJM 2008; 358:2003-15, see supporting evidence section). Almost half the women in the metformin arm required supplemental insulin to maintain glucose control (typically night time insulin, personal experience).The insulin dose was significantly lower in the metformin arm and maternal weight gain was less. Women preferred metformin. The trial conclusion was that metformin is a safe and effective alternative to insulin for women with GDM. Metformin is used as an option for treatment in a number of centres, but others are waiting until the offspring are followed up to see whether there are later effects. The two-year old offspring data have been published showing no difference in size or percentage body fat between offspring whose mothers were treated with metformin and those whose mothers were treated with insulin alone.

Avoidance of metformin is recommended if there is significant fetal growth restriction reflecting a probable placental problem (ok to use if appropriately small fetus), or there are maternal contra-indications, such as sepsis, significant GI upset, preeclampsia, renal failure or conditions that put women at risk of lactic acidosis.

Glibenclamide

Studies report undetectable or small amounts (more sensitive assays) of glibenclamide in cord blood. Glibenclamide is used in GDM in the USA. There are no follow up data on mothers or offspring. In theory, glibenclamide may hasten progression to type 2 diabetes in the mother. Later effects on the offspring are possible, but the amount detected in the fetus is low.

Other issues

Other issues in women with GDM consider checking vitamin D levels and B12 levels in those at risk for deficiency (see advice at the end of pre-pregnancy assessment – women with known diabetes section).

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10. Fetal complications

Macrosomia

This is the commonest measurable problem but even this is beset with definition difficulties (e.g. birth weight > 90th centile, > 4000g, > 4500g does not accurately identify all macrosomic foetuses. Customised growth centile may be helpful, but do not report relative growth of the abdomen). It is the pattern of abnormal growth more than absolute weight which is typical of macrosomia. This is very important with our multiethnic delivery populations. The abdominal circumference centile compared with other measurements is important to note on the ultrasound chart, as the GROW chart alone does not provide that information. For example, Indian babies have been shown to have the same body fat as an English Caucasian baby when the Indian baby is 800g lighter. Macrosomic infants have organomegaly due to increased deposition of fat. Their fat distribution makes them large around the shoulders and abdomen. The marker for macrosomia on ultrasound scan is an increased abdominal circumference. Studies in poorly controlled diabetics give risk of macrosomia of around 30%, reducing to < 10% with good control. Macrosomia increases risks for the fetus of:

- Shoulder dystocia
- Birth trauma
- Need for LSCS (two-fold increased risk if macrosomic, from HAPO data)

IUGR

Igur is seen in situations of maternal vascular complications or superimposed hypertensive disorders.

It is also more likely if a woman has a very high HbA1c at conception, as this interferes with placental development.

Sudden intrauterine death

This is rare with better control of diabetes using home blood glucose monitoring and timely delivery. It usually occurs in the last few weeks of pregnancy. Routine fetal monitoring has not been shown to help prevent this outcome.

Prematurity

Prematurity is usually due to other maternal or fetal complications leading to early delivery, but there is also a small increase in spontaneous preterm birth associated with hyperglycaemia. Of note, in women with poorly controlled type 2 diabetes, there is an increased rate of preterm membrane rupture and delivery between 20 – 24 weeks.

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11. Maternal complications

Women are at increased risk of:

- Hypertensive disorders/preeclampsia (overall risk 25 - 30% of gestational hypertension or preeclampsia) and lower in women without vascular complications (8 - 15%). Rates of preeclampsia in women with GDM are 3 - 5%, and up to 15 - 20% overall in women with type 1 diabetes in Auckland. Good diabetes control reduces the risk of preeclampsia
- Birth trauma
- LSCS: rates at National Women's Health about 37% in women with GDM (not increased compared with the background population) and 50 - 60% in women with type 1 or type 2 diabetes
- Urinary tract infection

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12. Antenatal issues

a) Hyperemesis

Women with diabetes who are admitted to the ward require additional input with respect to their diabetes management. Contact the diabetes team to inform them of the admission. After hours, phone the physician on call as needed.

Information needed for appropriate management of hyperemesis

- Type of diabetes (type 1 or type 2): this is very important as women with type 1 diabetes will require insulin even if they are not able to eat. They usually require a dextrose insulin infusion (see CR3782: Maternity Service Insulin / Dextrose Infusion - Antenatal). Women with type 2 diabetes may not require insulin or any other diabetes medication when they are vomiting
- Usual medication plus doses and blood glucose readings over previous 48 hours if possible
- Gestation, weight often useful
- Whether eating at all and what intravenous fluids are already set up

Management

General management of hyperemesis is as for all women with Hyperemesis (see associated ADHB documents section).

Additional management issues:

Type 1 diabetes and hyperemesis

If not eating and drinking, will require a dextrose/insulin infusion (see CR3805: Maternity Service Insulin / Dextrose Infusion – Antenatal). Note the antenatal infusion protocol does not routinely have potassium added. Clinicians should prescribe appropriate potassium replacement in other IV fluids or specifically request addition of potassium to the dextrose/insulin infusion.

Use the type 1 diabetes antenatal protocol, noting that in early pregnancy the insulin infusion rates may need to be decreased, especially if women usually treated with Lantus/glargine, as the effect of the last dose may last 24 hours. Liaise with the physician if recommended glucose levels are not maintained, as the protocol may require modification on an individual basis.

Monitor capillary glucose levels 1 - 2 hourly as requested by the physician.

Once eating, the woman should change back to subcutaneous insulin and doses should be decided by physician. If eating is sporadic, some women keep infusion going for a while and the woman has small subcutaneous bolus of insulin using her insulin pen when she eats

If the woman is still vomiting intermittently after eating food, it may be wise to give the mealtime short-acting insulin bolus after eating then the dose can be

adjusted according to volume eaten and whether the woman feels nauseated. It can be given within 30 minutes from start of eating. This should be a temporary measure only.

In general, anything that helps a woman to eat is particularly useful (e.g. encourage the use of antiemetics).

Type 2 diabetes/GDM and hyperemesis

Stop all oral diabetes medications. This is very important for Metformin, which should not be taken during any acute illness or when vomiting.

If on insulin, withhold insulin as well and monitor capillary glucose levels 2 hourly initially. If the woman's glucose levels are stable off medication, less frequent testing may be acceptable (discuss with physician).

If glucose levels are increasing above 7 - 8.0mmol/l during the time the woman is not eating, the woman is likely to require insulin. The physician may request dextrose/insulin infusion and manage as a type 1 as detailed above. This is an uncommon situation.

Once the woman starts eating, medication will be required when the glucose levels start to increase above the pregnancy ranges. There is no emergency and the physician should leave instructions about when to contact them/restart medication.

If the woman is prescribed insulin once she starts to eat, but is still vomiting intermittently, it may be wise to give the mealtime short-acting insulin bolus after eating then the dose can be adjusted according to volume eaten and whether the woman feels nauseated. It can be given within 30 minutes from start of eating. This should be a temporary measure only.

All women with diabetes and hyperemesis

- When the woman is discharged, ensure she knows her insulin/metformin doses
- Check that she has been given a prescription for antiemetics and any other medication she requires
- Make sure she has a follow up appointment in clinic
- Make sure she knows to return to hospital if she becomes unwell again

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b) Acute assessment (e.g. in WAU)

Contact the diabetes team to inform them of admission. After hours, contact the physician on call as required. They will want to know the following information:

- Type of diabetes
- Usual medication and doses
- Recent blood glucose recordings (the woman should have record paper or book)
- Gestation
- BMI (on risk sheet) and recent weight
- Reason for admission
- Whether eating or nil by mouth
- Whether there is a plan to give steroids

If eating

Regular meals are required (especially important for women on Insulin). When ordering please order:

- Morning tea with breakfast
- Afternoon tea with lunch
- Supper with dinner

Ask women to check and document blood glucose levels when admitted and before and after meals during assessment. Check with assessment doctor when they would like to be informed immediately of a result (e.g. if above a certain reading, for example if above 7.0 or 9.0mmol/l).

Often, women will be asked to continue their usual medication regimen – check the woman has brought her medicines with her from home in order to take an accurate medication history. In general, medications should then be given to a family member to take home, or stored in the drug room and returned to the woman (if still clinically appropriate) on discharge. Medicines should be administered from ward stocks. Women are typically permitted to continue self-administering subcutaneous insulin, but this should be confirmed by the medical team.
If a glucose level is elevated, the woman may be asked by the doctor to give extra insulin.

If level < 3.5mmol/l (< 4.0mmol/l for women with type 1 diabetes) treat for hypoglycaemia if they are on insulin (see resources/protocols section). They will not have hypoglycaemia if diet-treated or on metformin alone.

If nil by mouth

Ensure it is known what type of diabetes the woman has, as this should determine management.

Type 1 diabetes and NBM

- The woman will require insulin always, so start a dextrose/insulin infusion according to antenatal protocol (see CR3782: Maternity Service Insulin / Dextrose Infusion - Antenatal). She may require additional potassium either in infusion or with other IV fluids
- Test blood glucose levels hourly and contact physician if levels outside range as listed on protocol
- Keep the diabetes team/physician closely involved
- Also determine what her glucose levels and insulin doses have been over the previous 24 - 48 hours
- Inform the diabetes team if steroids are going to be given, as the dextrose/insulin infusion protocol will need to be modified (typically, insulin doses will need to be doubled at least from about 8 hours after first steroid injection)

Type 2 diabetes/GDM and NBM

- Stop diabetes medication and inform diabetes team
- A dextrose/insulin infusion is not required routinely. Monitor glucose hourly initially and inform physician if levels persistently above 7.0mmol/l. If stable and within range, change to 2 hourly monitoring
- If steroids are given and she remains nil by mouth, a dextrose/insulin infusion may be required from about 8 hours after initial steroid injection. Discuss with the physician

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c) Steroid administration

Glucose levels in women with diabetes who are given steroids for fetal lung maturation can be difficult to manage. Communication is the key and the following points are vital:

- Liaise with the doctor who is going to manage the woman's diabetes before the first dose of steroids is given (or within a few hours if given at admission/during the night), so changes to insulin treatment can be planned appropriately. This is usually through contacting the diabetes team, the obstetric medicine registrar, diabetes physician or physician on call
- The physician managing changes in insulin doses needs to be regularly contacted with the maternal blood glucose readings for at least 72 hours after steroids are initiated

If the physician is contacted by phone, it is important to be able to tell the physician the following information:

- Maternal type of diabetes, gestation, weight, time of steroid injections
- Indication for steroids and likelihood of delivering in next few days
- Usual doses of diabetes medications and control (for example glucose readings and insulin doses in previous 48 hours)
- Whether the woman is eating and drinking or nil by mouth

Women require extra insulin (typically double their usual doses) from about 8 hours after steroids are initiated until 24 - 36 hours after the second dose of steroids are given. Steroid effects often wane gradually after that, but occasionally women go back to their pre-steroid doses of insulin quite abruptly. If the obstetricians have some flexibility about the timing of the steroid injections, it is useful to give the first injection before bed, so the increase in insulin dose can be started with breakfast (though a smaller increase in overnight insulin also needs to be considered). The after breakfast blood sugar reading should allow the physician determine if an adequate dose increase has been made and to give an insulin correction if needed (see below), then by lunch time, the physician should have a good idea of insulin doses for the next 36 hours. Alternatively, give the first steroid at breakfast time, so the first increased dose of insulin can be given at dinner and ongoing insulin doses should be reasonably clear by bedtime.

Women having steroids are obviously considered to be at risk of a preterm delivery, possibly shortly after steroids are completed. Good maternal glucose control during this time may be very important for fetal well-being during steroid administration and in the neonatal period.

The commonest problem is that insulin doses are not increased enough, and once the glucose level becomes elevated it creates further insulin resistance so it is harder to bring the glucose level down. Liaising with an experienced clinician is important.

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d) Blood glucose monitoring and insulin regimen

For women who are still eating and drinking while having steroids:

Capillary glucose monitoring

- Pre meal
- 2 hour post meal
- Pre bed
- Overnight depending on control: at least a 02:00 hours test or if having problems with control, more frequently, especially if woman has type 1 diabetes with poor hypoglycemic awareness. Testing may be 2 hourly, especially when establishing the insulin dose required
- Also check 1 and 2 hours after any correction dose is given
- Check after treating any hypoglycaemia,10 - 15 minutes and 1 hour later

Insulin doses

If eating, women can be treated with subcutaneous insulin. In general, there is no need for dextrose/insulin infusions, as bolus insulin should still be required with meals. Both the long-acting basal insulin and short-acting meal insulin will need to be increased as below. As a general rule, the usual insulin doses can be doubled 8 hours after the first steroid injection.

Approximately 36 hours after the second dose of steroids are given; the woman can usually go back to her pre steroid insulin doses.

Women already on insulin and having steroids

Know the usual total daily dose of insulin for the woman and expect to approximately double the dose (basal and bolus doses) around 8 hours after the first steroid injection. Adjust according to glucose results (see below). The commonest problem is that a doubling of the dose is not enough.

If the initial increase in dose is not enough, the first problem encountered is that the glucose level after a meal is elevated. An appropriate correction dose at that point can be given to help decide how much extra insulin is required.

To do this logically, it is important to understand how to give a correction dose:

In general, a correction dose is the amount of insulin a person needs to bring their blood glucose down 1 mmol. This is calculated by adding up the total daily dose of insulin (short plus long-acting) and dividing by 100, e.g. if on 50 units/day, then 0.5 units decreases glucose by 1 mmol, if on 100 units/day, then 1 unit decreases it by 1 mmol. So, if the correction is 0.5 units and the blood glucose is 10mmol/l, 2 units should bring the glucose down to approx 6 mmol/l.

Therefore, if a woman is taking 100 units/day usually, the initial increase during steroid administration should result in a daily dose of 200 units. If this dose is correct, then 2 units will bring the blood glucose down 1mmol. So, if the capillary

glucose level is elevated after the first insulin dose increase (usually because the physician or woman is a bit anxious and does not double the dose or the hospital food is different or the increase is not enough) then give a correction to test whether doubling the dose is likely to work for the next injection. For example, if the glucose reading is 12mmol/l at 2 hours after the meal, calculate the correction dose to bring the level down to 6 mmol, (recognising that over the next hour or two the glucose is likely to drop a bit itself anyway from the residual meal bolus). So to go from 12mmol to 6mmol, give 6X 2 units=12 units and check the glucose level one and two hours later. If it is coming down appropriately with the correction, then doubling the usual daily dose is a reasonable estimation of the dose increase required. Prior to the next meal, if the glucose level is above 4mmol, then add a correction dose to bring the glucose down to 4 plus double the meal insulin (or further increase if it has been decided doubling is not enough i.e. the correction dose was inadequate to drop the glucose level). After that meal, the glucose levels should be in range. If the glucose does not drop adequately, the dose of insulin might need a further 30 - 50% increase. If hypoglycaemia develops (uncommon), then use a bit less than double for next meal after checking the bolus is appropriate for the food that will be eaten, as hospital food is often different from home.

It is important to also increase the basal insulin in a similar manner i.e. in general start with doubling the dose. If the first steroid has been given at breakfast and a double dose of bolus at dinner has been successful, it is appropriate to double the night time long acting. If the physician or woman does not have the confidence to do this and/or the glucose level is elevated during the night, a correction can be given with short-acting insulin.

Whenever a correction dose is given, the capillary glucose level should be checked 1 and 2 hours later to ensure further action is not required. If it is not decreasing, a further correction can be given, but remember there is already short-acting insulin still working.

For women with type 1 diabetes, it may be better to start with a less aggressive increase, as they could be very anxious about doubling their insulin and they may prefer initially to take a smaller dose and correct until they see the effect of steroids. So, it is reasonable to increase by 50 - 75 % with first increase in dose. Also, if a woman is on once daily lantus/glargine it can be useful to add a second dose in during steroid administration, as this allows adjustment of the daily dose more readily.

If the woman delivers while steroids are still having an effect, a woman with GDM or type 2 diabetes can stop insulin as usual at delivery, but should require ongoing monitoring and may need insulin at reduced doses until the steroids wear off.

If a woman with type 1 diabetes delivers during this time, also reduce the insulin dose, but not as aggressively as usual postpartum decrease.

Communication re dose adjustments during steroids - important

This is all rule of thumb, but works very well as long as the first few glucose levels are clearly relayed to the physician in a timely manner after the initial insulin dose adjustments are made. The physician cannot make a plan for the whole day until the effect of the first dose increase is assessed. There are several ways of managing this. One way is for the midwife to phone the physicians with each glucose level around the time initial dose adjustments are being made (usually 2 - 3 phone calls over 2 - 3 hours is enough). Alternatively, it is appropriate for some women to phone or text the physician directly so that information is immediate. Once the dose is clear, it is easy to write up further doses until the steroid effect is wearing off, with instructions for the physician to be phoned if levels are outside the recommended range (e.g. recurrent hypos or > 7.0mmol/l).

Diet-treated GDM during steroid administration

In general, women should need insulin treatment during steroid administration. Anticipate starting insulin from approximately 12 hours after first steroid injection is given.

It can be hard to decide an accurate dose, as their insulin sensitivity is not so clear. Using a formula can be helpful:

i. Start with calculating a 24 hour dose of 0.7 – 1.3 units/kg (depending on gestation, usual glucose levels, time of day, ethnicity etc). As a rule of thumb start with 1 unit per kg of current weight. Note, this is double the usual starting dose of 0.4 - 0.7u/kg because of the steroid effect);

ii. Aim to give 1/3 of that dose as a night-time intermediate insulin e.g. Protophane or Humulin N;

iii. The other 2/3 should be divided as Premeal short acting insulin analogue (e.g. Novorapid or Humalog).

Please note: full drug names should be used when prescribing.

Example 1: 60 kg Asian woman

Estimate: 42 - 70 units/day (or just go for simple 60 units/day) from 12 hours after first steroid:

i. Give 14 - 22 units as night-time Protophane;

ii. Give 10 - 16 units premeal Novorapid.

Suggest for this woman, give 10 units before the meal 8 – 12 hours after steroids are commenced and see what the post meal glucose is. If > 7.0 mmol/l, the dose before the next meal can be safely increased. If starting the insulin at night,

consider giving only 14 units Protophane. If the glucose level is elevated at 0200 hours, a correction with Novorapid is reasonable.

Example 2: 120 kg Pacific Island woman

i. Estimate: 90-160 units/day (or go for 120 units/day);

ii. Give 30 - 40 units as night-time Protophane;

iii. Give 20 – 30 units premeal Novorapid.

Approach as woman above, starting with lower end of the range as an initial dose and adjust upwards. Higher doses can be used in third trimester and in higher BMIs.

Remember, many of these women should need much more than this and hypos tend to be mild in women with GDM or type 2 diabetes as they can switch off their own insulin production as their glucose level drops.

Women with preeclampsia are sometimes more insulin sensitive, as the placental function may be compromised, so in this situation, the first increase may be more cautious.

Women who are nil by mouth and having steroids (as may require delivery any time)

- Capillary glucose monitoring
- Usually 2 hourly testing should be adequate, but may need 1 hourly testing if levels above 7 mmol/l or type 1 diabetes

These women should require an antenatal insulin/dextrose infusion (see CR3782: Maternity Service Insulin / Dextrose Infusion - Antenatal). The infusion needs to be modified for a woman who is having steroids, typically by doubling the insulin doses from about 8 hours after first dose of steroids and adjusting further as required. This is best done by writing on the infusion document with new ranges of insulin doses and liaising by phone.

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e) Fetal surveillance/monitoring

- Outpatient surveillance of fetal well-being is as per usual obstetric indications
- Routine CTG or BPP is not required solely for diabetes
- Reduced fetal movements in a diabetic woman is a worrying symptom and should always be fully investigated with a CTG and/or BPP
- If a woman is admitted antenatally for diabetes control she should have at least daily CTGs
- Otherwise inpatient monitoring is as indicated by the obstetric factors

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13. Timing of birth

Timing of delivery depends on assessment of diabetes control in combination with complications such as macrosomia and preeclampsia. Most women with pre-existing diabetes and GDM with suboptimal glycaemia control/fetal macrosomia are delivered between 38 - 39 weeks gestation, and all women are delivered by 41 weeks gestation. This means that about 60% of women with diabetes at National Women's Health are induced.

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14. Induction and/or labour

It is important that women with diabetes maintain good control of their blood glucose during labour as good control may reduce the likelihood of neonatal hypoglycaemia.

Dextrose/insulin infusions are not used routinely in labour to maintain euglycemia. Women with type 1 diabetes are usually treated with an infusion, unless their labour is very fast. Women with type 2 diabetes or GDM on insulin rarely require an infusion, as their glucose levels usually remain stable once they are not eating and are in labour or due for LSCS.

Careful fetal monitoring in labour is important. Most diabetic women in established labour should have continuous electronic fetal monitoring, please see RANZCOG recommendations which are part of the National Women's Health guideline (see associated ADHB documents section for Fetal Heart Rate – Intrapartum Surveillance).

Induction and early labour are a time of transition between the normal routine of antenatal diabetes care and being unable to eat normal meals when in established labour. The duration of this period varies widely and the way this is to be managed has to be tailored to the individual woman. The following are to be used as a guide in combination with common sense. Ask when uncertain. The diabetes team expects to be used as a resource – after hours, please contact the physician on call.

Labour care for GDM managed with diet or metformin alone

- While still eating, these women should continue testing capillary glucose levels before breakfast and 2 hours after the start of meals. Aim for glucose levels between 3.5 - 6.0 mmol/L overall. If glucose measurements are persistently > 7.0 mmol/L, contact the diabetes team/physician as insulin treatment may be required
- Meals appropriate for women with diabetes should be ordered. If taking metformin with meals, continue medication until the woman is no longer eating (i.e. in established labour or nil by mouth for LSCS)
- Do not be concerned if a snack is missed or if the woman is not very hungry. She will not develop hypoglycaemia as she is not taking insulin
- If intravenous fluids are required, avoid fluids containing dextrose
- Once labour is established and woman is admitted to the delivery unit, the midwife should make assessment and notify the registrar from the team of the day or LMC
- Registrar or LMC to review antenatal management plan located on the "Pink Sheet" (Risk Plan) in the patient's clinical record and consider current situation. Review or amend and document accordingly
- Monitor glucose levels 2 hourly. Metformin should be stopped. If maternal glucose levels remain above 7.0mmol/l for an hour or if it rises above 8.0mmol/l, contact the diabetes team/physician (this is very uncommon). A dextrose/insulin infusion is not required unless requested by the diabetes team
- Metformin treatment should only be restarted after delivery if requested by the physician

Labour care for GDM or type 2 diabetes managed with insulin (or insulin plus metformin)

- Let the diabetes team know the woman has been admitted. After hours, call the physician if any problems. See information required for phone consultation with physician below if there are concerns about the woman's medication or glucose levels
- Check in the patient's clinical record whether there are any specific instructions about management of their medications in labour
- If not, the women should continue her usual subcutaneous insulin (and metformin) and meals and monitor blood glucose before breakfast and 2 hours after start of meals
- If the woman appears to be in early labour and insulin is due please check dosage with physician as this may need adjusting (reducing)
- If a glucose measurement is > 7.0 mmol/L, contact diabetes team/physician, as insulin doses may need modifying
- If the glucose is < 3.5 mmol/L or the woman develops symptomatic hypoglycaemia, treat with glucose tablets first and subsequent protein snack e.g. glass of milk or cheese sandwich (see section on management of hypoglycaemia below). Contact the physician as insulin may need modifying
- Once labour is established and the woman is admitted to the delivery unit, midwife should make an assessment and notify the registrar from the team of the day or LMC
- Registrar or LMC to review antenatal management plan located on the "Pink Sheet" in the clinical record and consider current situation. Review or amend and document accordingly
- If the women is NBM she does not require an insulin/dextrose infusion except on rare occasions:
  - The woman has repeated episodes of hypoglycaemia that cannot be managed with oral glucose
  - The blood glucose level remains above 7.0mmol/l for more than an hour or if the glucose level is above 8.0mmol/l
  - But, use common sense – if labour is progressing very rapidly then an insulin/dextrose infusion is not necessary
  - Insulin should not be restarted after delivery unless requested by a physician. Occasionally, a woman with type 2 diabetes continues with high glucose levels (above 9mmol/l) and the physician should be contacted to decide whether insulin should be restarted. This is not usually an emergency and the decision to restart insulin is usually made over 12 - 24 hours. However, it may be earlier if glucose levels are > 11mmol/l

Labour care for type 1 diabetes

- Let the diabetes team know the woman has been admitted. After hours, call the physician if any problems. See "information required for phone consultation with physician" below if there are concerns about the woman's medication or glucose levels
- Check in the clinical record whether there are any specific instructions about management of their medications in labour. Also, confirm there is a documented

plan for insulin treatment after delivery, as doses will be less than pre pregnancy doses immediately after delivery. If there is no plan, ask the diabetes team/physician for advice. If this is noticed in the middle of the night, this can wait until morning and if the woman delivers overnight, a dextrose/insulin infusion can continue until breakfast time

- The woman should continue her usual subcutaneous insulin and meals and monitor blood glucose before breakfast and 2 hours after start of meals
- If the woman appears to be in early labour and insulin is due please check dosage with physician as this may need adjusting (reducing)
- If a glucose measurement is > 8.0 mmol/L, contact diabetes team/physician, as insulin doses may need modifying
- If the glucose is < 4.0 mmol/L or the woman develops symptomatic hypoglycaemia, treat with glucose tablets first and subsequent protein snack e.g. glass of milk or cheese sandwich (see section on hypoglycaemia below). Contact Physician as insulin may need modifying
- Once labour is established or the woman is NBM she requires an insulin/dextrose infusion, unless labour is progressing so quickly there is not time to set it up
- Insulin should continue after delivery. If on a dextrose insulin infusion, change from antenatal protocol to postnatal protocol (halve the insulin rate - see CR3805: Maternity Service Insulin / Dextrose Infusion – Postnatal). Once a woman is ready to eat and it is daytime, she will require subcutaneous insulin and the infusion can be stopped. Ensure the woman is given the doses recommended postpartum (on HealthWare risk sheet) and if a postpartum plan cannot be found, phone the physician. Do not give the dose the woman was on prior to delivery, as this will be too much and the woman may develop severe hypoglycaemia

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15. Elective caesarean

GDM or type 2 diabetes

- Managed with diet, metformin alone or insulin +/- metformin
- They should have been nil by mouth since midnight (for morning slot) or after early breakfast (afternoon slot). If they have been taking metformin, the last dose of metformin is with their final meal. If they have been taking insulin, the final dose should have been either the night before, if morning slot, or with an early breakfast if afternoon slot. The diabetes team should have reduced the final insulin doses to avoid risk of hypoglycaemia once the woman is nil by mouth
- Monitor capillary glucose levels 2 hourly if between 3.5 - 7.0mmol/l
- They do not require a dextrose/insulin infusion as a general rule. There may be rare exceptions:
  - Women who have presented late/with poor control: if glucose levels persistently > 8.0mmol/l contact the diabetes team for advice about infusion and frequency of monitoring
  - Women who have been on insulin and develop symptomatic hypoglycaemia. If it is mild, it is generally acceptable to give 3 - 4 Glucose tablets to treat, but if recurrent or more significant, the woman may require a dextrose infusion

Type 1 diabetes

- Always managed with insulin
- These women should come in nil by mouth and have a dextrose insulin infusion before going to the operating room (see CR3782: Maternity Service Insulin / Dextrose Infusion - Antenatal). Of note, now that women are often on Lantus as their basal insulin, which lasts about 24 hours, they should still have basal insulin in their systems and a proportion of women only require dextrose. The insulin infusion rates may need to be modified in this situation, and only started once the glucose level is > 7.0mmol/l. The postnatal protocol should be with their records so that the insulin dose is appropriately decreased at delivery. If a woman has not had her Lantus dose decreased the day before delivery, she may be at increased risk of hypoglycaemia for a number of hours postpartum and may require no insulin initially
- These women should all have a postpartum treatment plan in their clinical record. If it is not documented, please inform the diabetes team so it can be organized before the woman starts to eat and restart subcutaneous insulin
- Rarely, a woman using an insulin pump through pregnancy (CSII) may continue this on a basal rate during delivery. This needs to be discussed and decided on an individual basis

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16. Postpartum

It is important to make sure which type of diabetes the woman has, as this modifies postpartum management.

Type 1 diabetes

- A postpartum insulin plan should be in the clinical record. If not, contact the diabetes team or physician on call prior to stopping the dextrose/insulin infusion. These women should not be without insulin. Do not give the doses the woman was on the day before delivery, as she should require much reduced doses, less than early pregnancy doses. If she is given too much insulin she is at risk of severe hypoglycaemia. Most women require about 2/3rds of their early pregnancy dose.
- The diabetes clinic maintains close contact to help women re-establish their insulin needs and control over the first few weeks postpartum
- Women should continue testing blood glucose levels before and after meals, and at least once during the night, when up with the baby or at 0200 hours approximately
- Consider restarting an ACE-inhibitor
- At discharge ensure they have adequate medication at home, or a prescription if required
- Women should have an appointment in the diabetes in pregnancy clinic at 6 - 8 weeks postpartum, with a recent HbA1c and other bloods as requested by the physician.
- Appropriate follow up at a diabetes centre should be arranged

GDM or type 2 diabetes

- All diabetes medication is stopped at delivery
- Initial monitoring 2 hourly while nil by mouth if had LSCS and fasting plus 2 hours post meals when eating. Contact the diabetes team if level > 9.0mmol/l. After hours, contact the physician on call if > 11.0mmol/l
- If levels all acceptable during first 24 hours after delivery, monitoring can be stopped in women who were diet-controlled or on metformin alone during pregnancy
- For women who had been treated with insulin or have a diagnosis of type 2 diabetes, continue monitoring until instructed to stop by diabetes team. Some women should be restarted on diabetes medications prior to discharge
- If hyperglycemia is present postpartum, then metformin may be prescribed. Women who breastfeed may take metformin, recognising a very small amount crosses to the baby but is not thought to have a clinically significant effect. Recently it has been shown that glibenclamide and glipizide are not detected in breast milk, so they may also be considered
- Women with type 2 diabetes or GDM who are subsequently confirmed to have diabetes should have a clinic appointment in the diabetes in pregnancy clinic at 6-8 weeks postpartum or a letter should be written to their GP for follow up.

- Some women will require an appointment for obstetric review if there were significant delivery complications or specific contraception through the clinic is planned
- There is a big emphasis on diet, exercise and weight loss at this stage
- Ongoing follow up of recognised type 2 should be organised prior to hospital discharge

GDM screening postpartum

All women who have GDM should have a test to see if they have underlying prediabetes or diabetes postpartum. An HbA1c (+/- fasting glucose is now recommended if requested by the physician) at 3 months postpartum with the result to the GP for follow up. This is less sensitive that an OGTT, but is associated with improved uptake of testing and hopefully makes it more likely they will continue with ongoing surveillance. This should be handed over to the GP. See associated ADHB documents section for GDM postpartum follow up letter to GP.

Women who have been identified as previously unrecognised diabetes during pregnancy should have follow up testing as felt to be appropriate. Many are likely to be on medication still after delivery, so the HbA1c should be for monitoring control, rather than for diagnosis.

The risk of subsequent diabetes is high after GDM. In studies that have followed up women for < 6 years the risk varied from 3% - 50% and is up to about 80% over 20 year follow up. At National Women's Health, 30% of women with GDM have prediabetes or diabetes at the initial postpartum check, highlighting the high risk group that is identified during pregnancy. In Australia, where a lower diagnostic threshold is used to diagnose GDM, 30-70% are abnormal within 5 years. Factors that are associated with an increased risk of subsequent diabetes include high fasting glucose in pregnancy, diagnosis in early pregnancy, need for insulin treatment and obesity. Weight gain after pregnancy and a subsequent pregnancy have been shown to speed up the rate that diabetes appears.

All women who had GDM need 1 - 2 yearly screening for diabetes and other cardiovascular risk factors. An HbA1c measurement is generally recommended annually, depending on the result and women's progress with lifestyle intervention.

Recurrence of GDM in next pregnancy

Women who have GDM in one pregnancy usually (50 - 70%) develop it in a subsequent pregnancy. They may be able to reduce the risk of recurrence by losing weight and maintaining good dietary habits. They should be tested in the first trimester in a subsequent pregnancy (see screening for GDM flowchart section).

Contraception

Contraception should be discussed. Be aware that in a breastfeeding woman, who is therefore oestrogen deficient, unopposed progesterone does increase insulin resistance. In this situation it may be better to consider alternatives to progesterone

only contraception or use it for a short time only. However, this may be the only acceptable choice for some women and better than an unplanned pregnancy.

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17. Neonatal

Neonatal hypoglycaemia

Hypoglycaemia in a neonate is defined as capillary glucose < 2.6 mmol/l.

National Women's Health recommends that babies are monitored within an hour of birth and pre-feed. When glucose is < 2.6 mmol/L a small supplemental feed or glucose gel is given (usually some time on the breast if not too low, a cup feed, or nasogastric feed up to 25 mL), giving breastmilk if possible. Intravenous dextrose is considered with recurrent levels < 2.3 mmol/l. This is a paediatric decision and would be given in NICU.

Polycythaemia

Polycythaemia may be secondary to fetal hypoxia and can lead to hyperbilirubinaemia and need for phototherapy.

There are data showing that offspring of women with diabetes have increased rates of obesity and type 2 diabetes. This means these children should have follow up and early lifestyle interventions to improve these risks. Breastfeeding is a very important component in this and should be encouraged whenever possible. Handover to the Well Child Provider regarding childhood follow up is recommended. Neonatal follow up is not routine in this regard (see associated ADHB documents section for background paper (for further information on complications) and links to neonatal guidelines):

- Management of Infants of Diabetic Mothers on the Postnatal Ward
- Management of Hypoglycaemia on the Postnatal Ward

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18. Resources for midwives caring for women with diabetes

a) Hypoglycaemia

This protocol is for women who are treated with insulin and or sulphonylureas (e.g. glibenclamide). If a woman is treated with diet or metformin alone she is not at risk of hypoglycaemia and does not require treatment.

i. Firstly document that the woman does have hypoglycaemia. If she has symptoms, hypoglycaemia should be confirmed with a blood glucose reading:
   - Blood glucose < 3.5 mmol/l (< 4.0mmol/l for woman with type 1 diabetes)
   - Symptomatic – e.g. sweating, dizziness, rapid heart rate, shaking, anxiety, weakness/fatigue, confused, irritability, hunger, pins and needles of lips and tongue, impaired vision, headache (she may have some or all of these symptoms)

Occasionally women on insulin have hypoglycaemia documented but no symptoms. It should still be treated especially in women with type 1 diabetes who sometimes lose their symptoms of hypoglycaemia. Instead they may present with feeling suddenly very tired or yawning a lot, mild confusion or inability to concentrate, or irritability. Severe hypoglycaemia can present if the woman is difficult to rouse, or if she is unconscious or fitting. Severe hypoglycaemia is an emergency and help should be summoned as an emergency.

ii. If able to manage oral treatment:
   - 3 or 4 glucose tablets or woman may have her own glucose treatment that she may prefer (e.g. 6 - 8 jelly beans, small juicebox etc, aim 15g sugar)
   - Repeat blood glucose every 15 minutes and repeat glucose tablets if necessary until blood glucose > 4 mmol/L
   - More recent evidence suggests treating hypoglycaemia is most effective if 0.3g/kg of glucose is given initially. If glucose reading is in low 2s or lower, giving a double dose of glucose initially is recommended

iii. If unable to swallow and cooperate with oral treatment:
   - Ask a colleague to phone for doctor assistance
   - Give Glucagon 1 mg IM. This takes 10 minutes to work but may avoid need for IV treatment
   - If has luer in situ, may be asked to give 100 - 150 mL of 10% IV dextrose
   - Aim to site luer if not already sited

iv. Once blood glucose above 3.5 - 4.0mmol/l, the woman should have small snack with complex carbohydrate and protein e.g.:
   - Crackers/cheese
   - Glass of milk

v. Then if meal time and woman recovered, the woman should have meal and usual insulin unless dose adjusted by doctor.

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b) Information required for phone consultation with physician

If phoning a physician about a woman with diabetes, a logical decision about medication changes may need to be considered. The following information should be at hand to enable the physician to make appropriate decisions:

- Type of diabetes the woman has (e.g. type 1, type 2 or GDM)
- Gestation and reason for admission
- Fetal condition and growth (especially whether growth restriction)
- Usual medication for diabetes (types of insulin if on insulin and how and when it is given, whether on metformin, other medications) with doses over the previous 48 hours (check with woman if not documented in her book/diabetes recording sheet)
- Blood glucose levels over the previous 48 hours
- BMI (from risk sheet) and recent weight
- Whether the woman is eating or drinking or there are plans for her to be nil by mouth or she is vomiting
- Whether there are plans to start steroids and when the first dose should be

When the physician requests a dose by phone, ask for it to be checked by another midwife and repeat doses, insulin type and timing back to physician.

Ensure this is documented in woman's record book and ward insulin plan.

Sometimes it is best for the woman with diabetes to talk directly to the physician. Use common sense and follow up with physician about doses as required.

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c) GDM resources for midwives

Lifestyle advice

In general, women are advised to follow healthy eating guidelines for pregnant women with the carbohydrate content modified for diabetes. The recommended diet composition is based on the following:

- 20% of calories from protein
- < 10% of calories from saturated fat
- ≤ 10% of calories from polyunsaturated fat
- 60 - 70% of calories from monosaturated fat and carbohydrate

The proportion of fat and carbohydrate is not clear from the literature. However, a low carbohydrate, high fat diet in animals is associated with more obesity in the offspring so it is reasonable to consider around 50% of calories from complex carbohydrate with low glycaemic index/load. Others suggest a minimum of 170g carbohydrate daily. Simple sugars should be avoided.

Women are advised to spread their caloric intake through the day, planning three meals with snacks between. Recommendations for total calorie intake are based on the woman's BMI (with a minimum of 1700cal/day).

Weight gain in pregnancy should be limited, depending on initial BMI. Further detail to assist advice can be found at National Women's Heath: Information and Referral Forms (see additional resources section).

Weight reduction during pregnancy is not aimed for. However, some individuals do reduce their weight as a result of healthier eating patterns and there are recent data in obese women with type 2 diabetes that show improved outcomes if weight gain is limited to <5kg.

It is not recommended to monitor urine ketones routinely.

Exercise is encouraged during pregnancy, aiming for 30 minutes at least 5 days a week. Strenuous workouts should be avoided, but walking, swimming and upper body exercises are encouraged.

Blood glucose monitoring

Women diagnosed with GDM are taught to test their blood sugars at home and report them back accurately. It is important to emphasise that honesty is imperative as some women will try to please with acceptable rather than accurate results and this benefits no one.

Accuracy will help the diabetes team to observe trends and advise on appropriate treatment as required.

The woman can phone, fax or email her results to the diabetes midwife or the midwife will contact her weekly (more often if required). She should also be asked

to bring her meter and log book to each clinic appointment. Meters can be downloaded in clinic; this is especially helpful if the clinical picture does not seem to correlate with the reported results.

Teaching a woman to test her blood sugars

- Ensure that the woman is comfortable and the people/person with her is supportive
- Before entering the room ensure that there is a meter (make sure that staff members know how to set the time and date on the meter and how to recall recent results)
- Also needed is a meter case, finger pricker pen, spare prickers, test strips that are in date and are compatible to the meter, log book or paper to record results, tissues and meter loan form
- Once in the room, explain why blood sugar levels are being monitored, this can be explained in a positive way. Put emphasis on the benefits of seeing the effect food and exercise has on blood sugar levels
- The aim is for the fasting blood glucose to be < 5mmol/L and the blood glucose to be < 6 - 6.5mmol/L 2 hours after the start of each meal. It is important to emphasise that the woman may not achieve these results without pharmacotherapy and she should not starve herself.
- The midwife role is to educate and guide the woman with dietary advice in a non judgemental way, recognising when treatment is appropriate and facilitating its implementation
- Women with GDM are taught to test their blood sugars 4 times a day
- On waking, it is important to do the test before eating or drinking anything to get accurate results
- In addition blood sugars should be tested 2 hours after the commencement of each meal, make sure the woman knows that she can not eat or drink anything other than water in that 2 hour period
- Show the woman the meter and the strips, making sure she knows how to calibrate the meter as appropriate. Ensure she knows to check the strips for their expiry date
- Show the woman how to assemble her type of pricker, inform her that she needs to change her needle every 2 - 3 days
- Demonstrate the part of the finger that it is best to prick and show her the angle. Explain that the side of the finger is less painful than the pad
- Ask the woman to demonstrate all that she has been taught washing her hands before pricking her finger; let her know she should be visited the next day to see how she is managing. Ensure that she has signed the loan form and given the money to order her some test strips

See associated ADHB documents section below for link to GDM patient information.

Teaching insulin

i. Assemble all equipment before commencing
   - Prescription for insulin and needles to give to woman
   - Insulin pens and spare needles to give to the woman. Try to give her two different coloured pens if she is commencing both short and intermediate acting insulin
   - Insulin for the pens the woman should take with her
   - 'Information for Women needing Insulin in Pregnancy' (booklet)
   - Either recording sheet or 'Blood Glucose Recording Book' for recording blood sugar levels
   - A box of tissues

ii. Ensure that the woman is comfortable in the room and ensure the person/people with her are supportive;

iii. Action
   - Discuss with the woman the different types (short acting and intermediate acting) of insulin and their different actions – include an explanation about how quickly they peak and how long the back ground action lasts. Make sure she is aware that she should eat when taking short acting insulin

iv. Administration
   - Demonstrate how the insulin pen is assembled, how the needles are attached, how to dial the correct dose of insulin and how to make adjustments if the dose is over dialled
   - Show the woman how to check a vial of insulin for expiry date, cracks, floating particles
   - Demonstrate the areas of the body where insulin can be administered and how to pinch the skin to do so. Remind her to count to ten before withdrawing the needle. Explain that there may be a little bleeding if a small blood vessel is struck with the needle
   - Ask the woman to demonstrate all of the things that have just been shown her including giving herself an injection (no insulin of course)

v. Dangers
   - Explain that insulin is safe in the correct doses but can be fatal if misused or in the wrong hands
   - Explain that needles and spare insulin should be kept away from children and not shared with friends or family members

vi. Dosage
   - Ensure that the woman knows what her starting doses of insulin are and that she can correctly dial to the correct dose
   - Show her on the piece of paper or 'Blood Glucose Recording Book' where to write her insulin doses in and where to write adjustments
   - Ensure the woman is aware that her insulin should be adjusted and this may happen over the phone when a staff member is with her or when the physician has been consulted

vii. Storage of insulin

- Ensure that the woman is aware that spare insulin should be stored in the fridge (not freezer) and not stored in the fridge door
- Ensure that the insulin pens are not left lying around at home or in a hot car

viii. Hypoglycaemia

- Discuss hypoglycaemia with the woman ensuring that she is aware of all the symptoms and how to treat. Make sure she is aware to follow up with a snack or meal following initial treatment

Give the woman the 'Information for Women needing Insulin in Pregnancy' booklet with all the information that just been given to her, making sure that she has the appropriate phone numbers if she has any questions or concerns. The teaching session should be documented in the clinical record.

It is important that the GP is informed about the woman's diagnosis of GDM and the plan for postpartum follow up. There are template letters that should be sent following the diagnosis of GDM, unless a specific letter has been dictated by a physician reviewing the woman. A second letter informing the GP about postpartum follow up can be sent postnatally when the woman has been given a laboratory form to do an HbA1c (ensure laboratory result goes to GP and copy to the diabetes service).

See associated ADHB documents section for links to all letters:

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19. Supporting evidence

- Crowther et al Effect of treatment of gestational diabetes mellitus on pregnancy outcomes NEJM 2005;352:2477-86
- HAPO Hyperglycemia and Adverse Pregnancy Outcomes NEJM 2008; 358:1991-2002
- Landon et al A multicenter, randomized trial of treatment for mild gestational diabetes NEJM 2009;361:1339-48
- Rowan et al Glycemia and its relationship to outcomes in the metformin in gestational diabetes trial. Diab Care 2010; 33:9-16
- Rowan et al. Metformin versus Insulin for the Treatment of Gestational Diabetes NEJM 2008; 358:2003-15
- IADPSG panel Gestational diabetes mellitus: why screen and how to diagnose Diab Care 2010; 33 (3):676-82

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20. Associated ADHB documents

- Antenatal Steroids for Preterm Birth
- Diabetes in Adults
- Fetal Heart Rate - Intrapartum - Surveillance
- Hyperemesis
- Management of Hypoglycaemia on the Postnatal Ward
- Management of Infants of Diabetic Mothers on the Postnatal Ward
- Medications - Administration
- Medications - Prescribing

Clinical forms

- CR3735: Diabetes Pregnancy Record
- CR2949: Maternity Diabetes Service Referral
- CR3782: Maternity Service Insulin / Dextrose Infusion - Antenatal
- CR3805: Maternity Service Insulin / Dextrose Infusion – Postnatal

Letters

- Vitamin D deficiency letter
- Community clinic GDM template letter
- GDM postpartum follow up letter to GP

Patient information

- Blood Glucose Recording Book
- Blood glucose testing (including recording sheet)
- Gestational Diabetes Mellitus (GDM) – patient information
- How to take Metformin – patient information
- Information for Women needing Insulin in Pregnancy (booklet)
- Medication options for GDM – patient information
- Pre Pregnancy Information for Women with Type 1 Diabetes
- Pre Pregnancy Information for Women with Type 2 Diabetes

Other resources

- Diabetes in Pregnancy - Background Paper
- Midwifery handbook (hard copy only)
- National Women's Heath: Information and Referral Forms

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21. Disclaimer

No guideline can cover all variations required for specific circumstances. It is the responsibility of the health care practitioners using this ADHB guideline to adapt it for safe use within their own institution, recognise the need for specialist help, and call for it without delay, when an individual patient falls outside of the boundaries of this guideline.

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22. Corrections and amendments

The next scheduled review of this document is as per the document classification table (page 1). However, if the reader notices any errors or believes that the document should be reviewed ***before*** the scheduled date, they should contact the owner or the Clinical Policy Advisor without delay.

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