

University Hospital Wishaw
Women's Services Directorate

Management of Diabetes and Delivery

Includes: the management of women with diabetes during labour and delivery (including LUSCS), the post-natal period and during administration of steroids for fetal reasons

This guideline is not intended for guidance on management of diabetic ketoacidosis or hyperemesis in the patient with diabetes.

It is imperative management of DKA in pregnancy is treated using NHS Lanarkshire DKA protocol (in Diabetes folder on Firstport).

Purpose

This document is intended to provide guidance on the management of women with pre-existing diabetes (type 1 and type 2 diabetes) and those with gestational diabetes when admitted to maternity units in the following circumstances:

- Induction of labour and delivery (including elective LUSCS)
- Steroid administration (for fetal reasons due to suspected pre-term labour or planned pre-term birth)

Please complete additional risk factor check lists at time of admission (e.g. VTE, PPH). Patients with diabetes may have additional co-morbidities and require MDT review prior to delivery (Anaesthetics, Neonatal).

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Glossary of abbreviations

ARM- artificial rupture of membranes
CBG- capillary blood glucose
CGM- continuous intermittent/flash glucose monitoring
CSII- continuous subcutaneous insulin infusion
CTG- cardiotocograph
DKA- diabetic ketoacidosis
FBC- full blood count
GDM- gestational diabetes mellitus
GI- glycaemic index
G&S- group and screen
HbA1c- glycated haemoglobin
LUSCS- lower uterine segment caesarean section
PPH- post-partum haemorrhage
U&Es- urea and electrolytes
VRIII- variable rate intravenous insulin infusion
VTE- venous thromboembolism

Section 1: Labour & delivery management for women with diabetes

For those taking insulin in pregnancy, or needing insulin for the first time during labour (due to a blood glucose consistently > 7.0 mmol/L), careful management of diabetes is required. Blood glucose levels persistently > 7.0 mmol/L in labour have been shown to lead to an increased incidence of fetal acidosis and neonatal hypoglycaemia.

There is strong evidence associating poor blood glucose control with adverse obstetric outcomes, both for women with pre-existing and gestational diabetes. Neonatal hypoglycaemia affects 25-30% of babies of mothers with diabetes and increases risk of impaired neurological development of the child.

Women using continuous flash glucose monitoring (CGM) or intermittent flash glucose monitoring (IGM) should be reminded that capillary blood glucose (CBG) tests are more accurate and are required during labour and delivery. In NHS Lanarkshire CGM systems used in pregnancy are the Dexcom G6 CGM and the Freestyle Libre 2 flash IGM. These can be continued during labour and delivery but it is also required that capillary blood glucose tests are measured as per the guidelines.

The target blood glucose in labour is 4-7 mmol/L, based on NICE guidance. The capillary blood glucose (CBG) should be monitored at the following intervals:

- Hourly in established labour for all women with diabetes
- Prior to LUSCS and half hourly under general anaesthesia

Section 1.1 Variable rate intravenous insulin infusion (VRIII)

A VRIII (formerly called an insulin sliding scale) is used to titrate the required insulin dose against the measured blood glucose with an IV dextrose infusion running at a constant rate.

Appendix A details the doses of the VRIII for ranges of blood glucose measurements for women in labour and delivery. *The starting rate is based on the capillary blood sugar at the point of the VRIII being commenced.*

Appendix B details the doses of the VRIII for ranges of blood glucose measurements for women receiving antenatal steroids. However, not all women on insulin receiving antenatal steroids will require a VRIII and the decision to commence this should involve the on-call Obstetric Consultant.

Section 1.1.1 When to start the VRIII

- For women with type 1 diabetes, commence VRIII at time established labour is confirmed (either spontaneous or induced) or at 7am on day of elective LUSCS.
- For women with type 2 diabetes and GDM who require a large doses of insulin, commence VRIII at time labour is established or at 6am on the day of elective LUSCS.
- VRIII should be commenced if two consecutive CBGs are > 7 mmol/l (with the second within 30 minutes of the first CBG > 7 mmol/l to prevent any delays)

Please review the intrapartum and postnatal management plans on Badger or seek senior advice if unsure.

Section 1.1.2 Administration of the VRIII

Commence VRIII at appropriate rate (see Appendix A for details) via syringe driver:

- In a 50ml syringe prepare 50 units soluble insulin (Actrapid® or Novorapid) in 49.5ml normal saline (1 unit = 1ml). **Use an insulin syringe to measure out the insulin dose.**
- Prime the giving set with 5ml of infusion fluid (containing insulin) prior to commencing the infusion
- Alongside the VRIII, run a substrate IV fluid of 500 mls NaCl 0.9% + 5% glucose + 0.3% KCl (20mmol) in a pre-mixed bag. This should generally run at a rate of 50 mls / hour
- Check U&Es 4-6 hourly in labour or if the patient is on a VRIII for more than 4 hours. Use blood ketones and if ketoacidosis is suspected check a venous bicarbonate.

While on a VRIII, if CBG < 4 mmol/L stop the insulin for 20 minutes and treat hypoglycemia with appropriate food/drink or commence an IV 5% dextrose infusion if nil by mouth. Re-check CBG in 10 minutes. Continue the IV infusion of 5% Glucose until blood glucose >7. Also remember to perform a CTG.

The rate of IV fluid will have to be considered in relation to individual patient factors (e.g. fluid status, electrolyte imbalances and fluid restriction such as in severe pre-eclampsia).

Where syntocinon is being concurrently infused, ensure that syntocinon is diluted in NaCl 0.9%.

Section 1.2 Induction of Labour or LUSCS for women with diabetes

Women who have type 1 diabetes will all be on insulin therapy and will require a VRIII in labour or during a LUSCS. Women with type 2 diabetes may be on insulin. Women with gestational diabetes may be managed by diet control, metformin or insulin therapy. The type of management that the woman is receiving will determine timing of admission and method of blood glucose control during labour and delivery. *Please review the intrapartum and postnatal management plans on Badger or seek senior advice if unsure.*

Section 1.2.1 Admission for Elective LUSCS for women with diabetes on insulin

For women with type 1 or type 2 diabetes on insulin admit at 2pm the day before their elective LUSCS. Some women with Type 2 diabetes or GDM on insulin may not require admission the day before if they are not requiring large doses of insulin. *Please review the intrapartum and postnatal management plans on Badger or seek senior advice if unsure.*

See appendix C for admission checklist.

- Give usual evening meals and insulin and then fast from midnight for women having an elective LUSCS (however oral intake of clear fluids should be encouraged).
- At 7am commence VRIII, or earlier if blood glucose levels are unstable overnight
- Omit breakfast and short acting insulin on morning of LUSCS
- Continue long acting basal insulin while on VRIII

Section 1.2.2 Admission for Elective LUSCS for women with diabetes on metformin or diet control

For women with diabetes (type 2 or GDM) on metformin only admit at 7am on the day of their elective LUSCS. Omit their morning metformin.

See appendix C for admission checklist.

CBG should be monitored hourly

Section 1.2.3 Admission for induction of labour for women with diabetes on insulin.

For women with type 1 or type 2 diabetes on insulin admit at 2pm (irrespective of parity), the day before anticipated labour (i.e. when suitable for ARM). *Please review the intrapartum and postnatal management plans on Badger or seek senior advice if unsure.*

For women with type 1 diabetes or type 2 diabetes, commence VRIII at time established labour is confirmed or ARM is performed.

Section 1.2.4 Admission for induction of labour for women with diabetes on metformin or diet controlled

For women with diabetes (type 2 or GDM) on metformin admit as per usual protocol (i.e. according to parity and any other obstetric factors).

CBG should be monitored hourly when in established labour.

Section 1.3 Management of labour and delivery for women on insulin pump therapy

All women on an insulin pump (continuous subcutaneous insulin infusion, CSII) have type 1 diabetes. Women on an insulin pump may choose to continue their insulin pump during labour or during a caesarean section. This should have been discussed in advance with their treating diabetes physician. If the woman decides to not use her pump, it should be disconnected and removed with the VRIII is commenced to prevent accidental overdose. *A pump plan should be available to the patient from 32 weeks and will be scanned into her notes or she will have a paper copy for reference.*

During labour this will likely require the use of correction boluses and/or temporary basal rate changes to maintain optimal glycaemic control.

If the woman (or partner if they are assisting as required) are unable to manage her own insulin requirements or if blood glucose levels become unstable (CBG > 7 mmol/l on 2 consecutive occasions or blood ketones > 1.5 mmol/l) then then switch off the pump and commence a VRIII (see appendix A).

The pump should remain in place on the basal settings in order to facilitate safe transition to the post-natal regimen.

For women having a caesarean section, the pump settings can be changed to post-partum doses just before the operation begins.

Section 2: Postnatal management of women on insulin

Following delivery of the placenta insulin requirements fall dramatically and hypoglycaemia is extremely common. For this reason, women should be encouraged to relax their glycaemic control, aiming initially for target CBGs of 6-10 mmol/L.

Due to the abrupt change in insulin requirements, doses should be reviewed each day by the obstetric on-call team and when required receive input from the diabetes team. Postnatal follow up should be discussed prior to discharge.

In breast-feeding patients, hypoglycaemia is more common and therefore they should be encouraged to drink and have a carbohydrate-based snack (10-15g of carbohydrate) prior to feeding or expressing. Consider a further reduction in insulin based on calorie and carbohydrate intake.

Ensure that contraception/plans for future pregnancy and lifestyle advice are discussed with women prior to discharge from maternity services for all patients with diabetes during pregnancy. Women with pre-existing diabetes should have a plan for ongoing diabetes care and follow up.

Section 2.1 Postnatal management for women on a VRIII

- Half the VRIII rate for women with type 1 and type 2 diabetes
- For women with GDM, stop VRIII
- Aim to stop the VRIII 30-60 minutes after the first meal (additional insulin is not normally required with the first light meal after delivery).
- Continue hourly CBG monitoring until the first meal or until the VRIII has been discontinued.
- Subsequently monitor CBGs as per pre-pregnancy regime (or pre-meals or pre-bedtime), aiming for CBG 6-10mmol/l.

Resume post-partum insulin as per the patient's individual care plan by the diabetes team. If this is not available, reduce the lowest dose in pregnancy (at about 12 weeks' gestation) by 25%, or reduce to at least 50% of the late pregnancy dose.

If the blood glucose is unstable and the woman is vomiting or unwell due to other complications, then refer to the obstetric or diabetic team. Continue the VRIII until the patient is permitted and able to tolerate oral intake.

A woman should not be left unsupervised to self-administer subcutaneous insulin if she has recently received diamorphine or other opiate-based analgesia or has had a recent general anaesthetic.

Section 2.2 Postnatal management for women on an insulin pump

Women must change their pump to post-natal settings as agreed in their individualized care plan. If the pump has been discontinued and removed when the VRIII commenced, the pump should be re-connected for an hour prior to stopping the VRIII and only re-start once the women feels she is able to manage her own pump settings.

If an individualised care plan is not available, use the following guide and refer to the diabetes specialist team as soon as possible:

- Basal rates should be reduced to 0.5 units per hour
- Insulin to carbohydrate ratios should be changed to 1 unit of insulin per 15g of carbohydrate
- Insulin sensitivity should be increased to 4mmol/l
- Blood glucose targets should be increased to 6-10mmol/l

Note that an insulin bolus is generally not required with the first light meal following delivery.

Section 3: Postnatal management of patients on oral glucose lowering drugs

- If metformin therapy was commenced for GDM this should be stopped.
- If on metformin or glibenclamide pre-pregnancy, re-commence once eating and drinking normally (discuss other oral glucose lowering drugs with diabetes team prior to re-commencing)
- Monitor CBG 4 hourly until the first meal
- Monitor CBG pre-meals and pre-bed subsequently aiming for blood glucose 6-10mmol/l
- Encourage low GI, healthy diet and weight management support as required

Please note metformin does not cause hypoglycaemia and can be safely taken while breastfeeding

Occasionally, a woman with GDM may be suspected of having underlying type 1 or type 2 diabetes pre-dating the pregnancy. These women will need careful postnatal blood glucose monitoring on the ward to assess their diabetic status.

Section 4: Post-natal follow up of women with GDM

For those with satisfactory blood glucose readings after delivery, CBG monitoring can discontinue. A formal fasting glucose should be undertaken at the GP surgery in 6-13 weeks' time. If this initial test is normal, an HbA1c should be offered annually (as per NICE guidance). Women will also be contacted by 'Weigh In' a NHSL weight loss programme if suitable, this will have been discussed with them in the antenatal period. *An anticipatory care plan with postnatal monitoring instructions and management plan should be available in the antenatal notes.*

Section 5: Antenatal steroid administration for women with diabetes

The risks with administration of antenatal steroids in patients with diabetes are hyperglycaemia and DKA. DKA is potentially extremely dangerous in pregnancy. It is widely acknowledged that the administration of antenatal steroids can lead to considerable challenges in maintaining euglycaemia in pregnant women with diabetes. This effect may last for 2 or 3 days and should be actively managed.

NICE recommend that women with diabetes on insulin should be given additional insulin according to an agreed protocol and are monitored closely.

The decision for antenatal steroids in patients with diabetes should always be consultant led (initial point of reference Dr Malcolm / Dr Jarvie, although it may be more appropriate to initially discuss with the on-call consultant out of hours).

When the decision is made to administer steroids an anticipatory care plan for insulin doses will be available in the notes and should be reviewed by the attending on-call team. Once the decision for the administration of steroids has been reached by the obstetric team, the Wishaw diabetes team may be contacted for advice (Dr McLaren / Dr Hill).

An individualised plan for changes to insulin requirement may be developed for patients in specific circumstances (e.g. those with placental insufficiency in whom there is a risk of hypoglycaemia due to falling insulin requirements).

- CBG should be measured hourly when women are admitted for antenatal steroids for fetal reasons

The most effective method to control steroid-induced hyperglycaemia is by using a VRIII (see appendix B).

- Check U&Es prior to starting the VRIII and repeat 24 hourly.
- Start the VRIII alongside the first dose of steroids. This may need to be continued until up to 24 hours after the second dose of steroids.
- Long acting insulin needs to be continued as normal. The meal time insulin should be stopped even if the patient is eating and drinking in order to keep the regimen simple.
- Target blood glucose range is 4-7.8mmol/L pre- and post- meal.
- CBG should be measured each hour
- Prepare the VRIII (see section 1.1.2 and appendix B)
- Alongside the VRIII, run 500 mls NaCl 0.9% + 5% glucose + 0.3% KCL (20mmol) (in a pre-mixed bag) at 50mls/hr

Please note additional fluids may be required if the patient is dehydrated or is not able to eat and drink normally. Fluids may have to be restricted in some patients (including those with hyponatraemia) and senior guidance should be requested for an individualised plan in these cases.

Patients with diabetes using an insulin pump may be able to maintain satisfactory glycaemic control using a correction boluses and temporary bolus rate increases. The input of the specialist diabetes team should be requested in these cases. In general, a 40% increase in insulin doses will be needed. If optimal glucose control is not achieved (e.g. 2 consecutive readings >7.8 mmol/L) then a VRIII should be commenced and the insulin pump switched off for future use.

References

Joint British Diabetes Societies for Inpatient Care. Management of glycaemic control in pregnancy women with diabetes on obstetric wards and delivery units. 2017. Available at URL:

https://www.diabetes.org.uk/resources-s3/2017-10/JBDS%20Pregnancy%202017%2020.10.17_0.pdf

National Institute for Health and Care Excellence. Diabetes in pregnancy: management from pre-conception to the post-natal period. 2015. Available at URL:

<https://www.nice.org.uk/guidance/ng3>

APPENDIX A- VRIII for women with diabetes during labour and delivery

The below table outlines the VRIII which should be used for women with diabetes during labour. For indications for use of VRIII for women with diabetes during labour and delivery, see Section 1.1.1.

Most patients will start on Algorithm 1, some will start on Algorithm 2.

	ALGORITHM 1 (for most women)	ALGORITHM 2 (for women with CBG not controlled on algorithm 1 or on >80units insulin/day)	ALGORITHM 3 (for women with CBG not controlled on algorithm 2 after consultation with oncall staff)
CBG level (mmol/l)	Insulin rate (units/hr = ml/hr)	Insulin rate (units/hr = ml/hr)	Insulin rate (units/hr = ml/hr)
<4	Stop insulin	Stop insulin	Stop insulin
4.0 – 5.5	0.2	0.5	1.0
5.6 – 7.0	0.5	1.0	2.0
7.1 – 8.5	1.0	1.5	3.0
8.6 – 11.0	1.5	2.0	4.0
11.1 – 14.0	2.0	2.5	5.0
14.1 – 17.0	2.5	3.0	6.0
17.1 – 20.0	3.0	4.0	7.0
> 20.1	4.0	6.0	8.0

Algorithm guide:

- Check CBG hourly while on VRIII and half hourly under general anaesthetic
- Target CBG 4-7mmol/l
- If CBG <4, stop insulin for 20 minutes, treat hypoglycaemia, then re-check CBG in 10 minutes
- If CBG is <4mmol/l or falling too quickly, move to the lower step of algorithm
- If CBG is above target and not falling towards target range, move to the higher step of algorithm
- If CBG targets are not being achieved on the above algorithms, contact the diabetes team for advice
- Alongside the VRIII, run a substrate IV fluid of 500 mls NaCl 0.9% + 5% glucose + 0.3% KCL(20mmol) in a pre-mixed bag. This should generally run at a rate of 50 mls / hour.

The insulin infusion should be delivered via a syringe driver and prepared as follows:

- In a 50ml syringe prepare 50 units soluble insulin (Actrapid® or Novorapid) in 49.5ml normal saline (1 unit = 1ml). **Use an insulin syringe to measure out the insulin dose.**
- Prime the giving set with 5ml of infusion fluid (containing insulin) prior to commencing the infusion

Appendix adapted from Joint British Diabetes Societies for Inpatient Care- Management of glycaemic control in pregnancy women with diabetes on obstetric wards and delivery units guideline (2017).

APPENDIX B – VRIII for women with diabetes receiving antenatal steroids for fetal reasons

Most patients will start on Algorithm 1, some will start on Algorithm 2.

The below table outlines the VRIII which should be used for women receiving antenatal steroids for fetal reasons. Start the VRIII and IV fluids with the first dose of steroids and continue for up to 24hrs after the last dose of steroids.

	ALGORITHM 1 (for most women)	ALGORITHM 2 (for women with CBG not controlled on algorithm 1 or on >80units insulin/day)	ALGORITHM 3 (for women with CBG not controlled on algorithm 2 after consultation with oncall staff)
CBG level (mmol/l)	Insulin rate (units/hr = ml/hr)	Insulin rate (units/hr = ml/hr)	Insulin rate (units/hr = ml/hr)
<4	Stop insulin	Stop insulin	Stop insulin
4.0 – 5.5	0.2	0.5	1.0
5.6 – 7.0	0.5	1.0	2.0
7.1 – 8.5	1.0	1.5	3.0
8.6 – 11.0	1.5	2.0	4.0
11.1 – 14.0	2.0	2.5	5.0
14.1 – 17.0	2.5	3.0	6.0
17.1 – 20.0	3.0	4.0	7.0
> 20.1	4.0	6.0	8.0

Algorithm guide:

- Check CBG hourly while on VRIII the management of steroid hyperglycaemia during pregnancy
- Target CBG 4-7.8mmol/l
- If CBG <4, stop insulin for 20 minutes, treat hypoglycaemia, then re-check CBG in 10 minutes
- If CBG is <4mmol/l or falling too quickly, move to the lower step of algorithm
- If CBG is above target and not falling towards target range, move to the higher step of algorithm
- If CBG targets are not being achieved on the above algorithms, contact the diabetes team for advice
- Alongside the VRIII, run a substrate IV fluid of 500 mls NaCl 0.9% + 5% glucose + 0.3% KCL(20mmol) in a pre-mixed bag. This should generally run at a rate of 50 mls / hour.

The insulin infusion should be delivered via a syringe driver and prepared as follows:

- In a 50ml syringe prepare 50 units soluble insulin (Actrapid® or Novorapid) in 49.5ml normal saline (1 unit = 1ml). **Use an insulin syringe to measure out the insulin dose.**
- Prime the giving set with 5ml of infusion fluid (containing insulin) prior to commencing the infusion

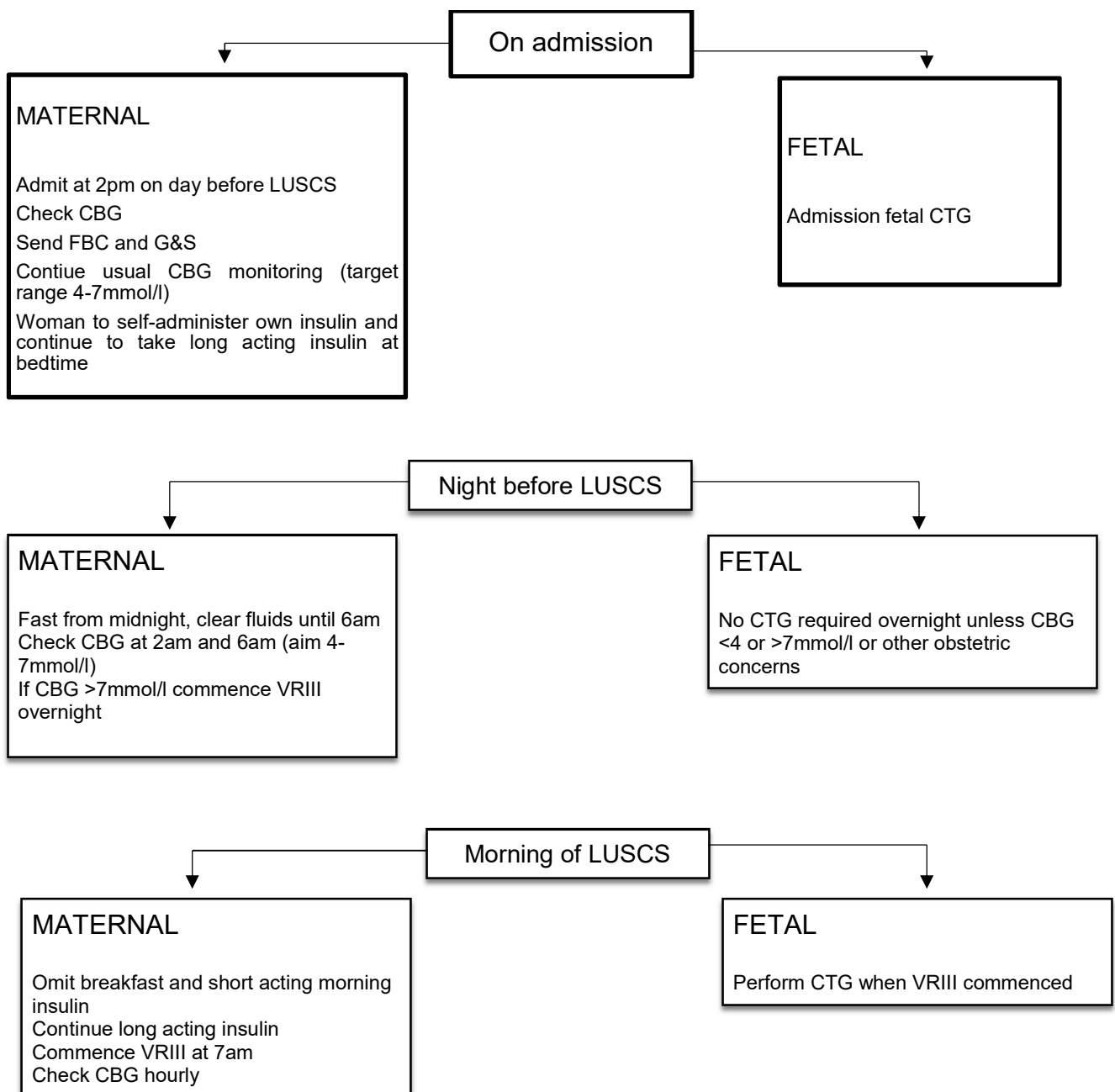
Appendix adapted from Joint British Diabetes Societies for Inpatient Care- Management of glycaemic control in pregnancy women with diabetes on obstetric wards and delivery units guideline (2017).

APPENDIX C – Flowchart for admission for patients with diabetes prior to elective LUSCS

Women with pre-existing diabetes (type 1 and type 2 diabetes) and women who develop GDM may be treated with insulin during their pregnancies. Some of these women may need to be admitted the night before their LUSCS because of their insulin therapy. This flow chart is to guide staff in how to admit and manage these women in the pre-operative stage of their birth.

Commencing a VRIII at an appropriate time for these women is imperative not only for maintaining the mother's blood sugar in a safe range but preventing neonatal hypoglycaemia and thus avoiding admission to the neonatal unit.

Please see full guideline above on intrapartum and postnatal management and instruction on how to make up the VRIII (Section 1).



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