University Hospitals Sussex
NHS Foundation Trust

Diabetes in Pregnancy

Maternity Protocol: MP018

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Contents

Key Principles

A protocol is a set of measurable, objective standards to determine a course of action. Professional judgement may be used in the application of a protocol.

Scope

This protocol applies to:

- Pregnant women and pregnant people with pre-existing diabetes
- Pregnant women and pregnant people being screened for gestational diabetes or diagnosed with gestational diabetes

Responsibilities

Midwives & Obstetricians & Diabetologists:

- To access, read, understand and follow this guidance
- To use their professional judgement in application of this protocol

Management Team:

- To ensure the protocol is reviewed as required in line with Trust and National recommendations
- To ensure the protocol is accessible to all relevant staff

1 Definition of Diabetes:

Diabetes mellitus is a metabolic disorder characterised by raised plasma concentrations of glucose, amino acids and fats. It is caused by either a reduction in the production and release of insulin from the pancreas (type 1), or by reduced sensitivity to insulin (insulin resistance and type 2) in the body's organs and tissues. This latter resistance can be transient in pregnancy, an effect of high concentrations of pregnancy hormones which act as antagonists to insulin action (gestational diabetes).

Approximately 700,000 women give birth in England and Wales each year, and up to 5% of these women and pregnant people have either pre-existing diabetes or gestational diabetes.

Diabetes in pregnancy is associated with risks to the woman or pregnant person and to the developing fetus. Miscarriage, pre-eclampsia and preterm labour are more common in women and pregnant people with pre-existing diabetes. In addition, diabetic retinopathy can worsen rapidly during pregnancy. Stillbirth, congenital malformations, macrosomia, birth injury, perinatal mortality and postnatal adaptation problems (such as hypoglycaemia) are more common in babies born to women and pregnant people with pre-existing diabetes.

The protocol focuses on areas where additional or different care should be offered to women and pregnant people with diabetes and their newborn babies.

Section 1: Pre-existing Diabetes

2 Pre-Pregnancy – routine diabetes care

2.1 The importance of avoiding an unplanned pregnancy is an essential component of diabetes education from adolescence for women and pregnant people with diabetes. Explain to women and pregnant people with diabetes that their choice of contraception should be based on their own preferences and any risk factors (as indicated by UK medical eligibility criteria for contraceptive use [UKMEC]).

2.2 **Pre-pregnancy planning**

2.2.1 Pre-pregnancy planning is provided by Diabetes Care For You (DCFY) or GP therefore early referral to antenatal clinic is essential.

2.2.2 Empower women and people with diabetes to have a positive experience of pregnancy and childbirth by providing information, advice and support that will help to reduce the risks of adverse pregnancy outcomes for mother/birthing parent and baby.

2.2.3 Explain that establishing good blood glucose control before conception and continuing this throughout pregnancy will reduce the risk of miscarriage, congenital malformation, stillbirth and neonatal death. These risks can be reduced but not eliminated

2.2.4 Advise women and people with diabetes who are planning to become pregnant:

- That the risks associated with pregnancy in women and people with diabetes increase with how long they have had diabetes
- To use contraception until good blood glucose control (assessed by HbA1c level) has been established

2.2.5 Advise women and people with diabetes, who are planning a pregnancy, information about how diabetes affects pregnancy and how pregnancy affects diabetes. The information should cover:

- The role of diet, body weight and exercise
- The risks of hypoglycaemia and impaired awareness of hypoglycaemia during pregnancy
- How nausea and vomiting in pregnancy can affect blood glucose control
- The increased risk of having a baby who is large for gestational age, which increases the likelihood of birth trauma, induction of labour and caesarean section
- The need for assessment of diabetic retinopathy before and during pregnancy
- The need for assessment of diabetic nephropathy before pregnancy
- The importance of maternal blood glucose control during labour and birth and early feeding of the baby, in order to reduce the risk of neonatal hypoglycaemia

- The possibility of temporary health problems in the baby during the neonatal period which may require admission to the neonatal unit
- The risk of the baby developing obesity and/or diabetes in later life.

2.2.6 Advise women and people with diabetes who are planning to become pregnant:

- To aim to keep their HbA1c level below 48 mmol/mol (6.5%), if this is achievable without causing problematic hypoglycaemia.
- Strongly advise women and people with diabetes whose HbA1c level is above 86 mmol/mol (10%) not to get pregnant because of the associated risks.
- A woman or person with Type 2 diabetes that has gone into remission after bariatric surgery should be advised to test their capillary glucose values with the same targets as below.

2.2.7 Advise women and people with diabetes who are planning to become pregnant to aim for the same capillary plasma glucose target ranges as recommended for all people with type 1 diabetes:

- A fasting plasma glucose level of 5–7mmol/litre on waking (ideally less than 5) and
- A plasma glucose level of 4–7 mmol/litre before meals at other times of the day.

2.2.8 **Diabetes treatment:**

- All other oral blood glucose-lowering agents excepting metformin, should be discontinued before pregnancy and insulin substituted.
- If the women and people has Type 1 diabetes, offer a ketone meter for monitoring.

2.2.9 **Cardiovascular risk:**

- Stop angiotensin-converting enzyme inhibitors and angiotensin-II receptor antagonists before conception or as soon as pregnancy is confirmed.
- Alternative antihypertensive agents suitable for use during pregnancy should be substituted.
- Stop statins before pregnancy or as soon as pregnancy is confirmed.

2.2.10 Offer women and people with diabetes who are planning to become pregnant individualised dietary advice.

2.2.11 Offer women and people with diabetes who are planning to become pregnant and who have a BMI above 25 kg/m2 advice on how to lose weight.

2.2.12 Start folic acid (5 mg/day) until 12 weeks of gestation to reduce the risk of having a baby with a neural tube defect.

2.3 Diabetes complications:

- Request retinal assessment to at their first appointment (unless they have had an annual retinal assessment in the last 6 months).

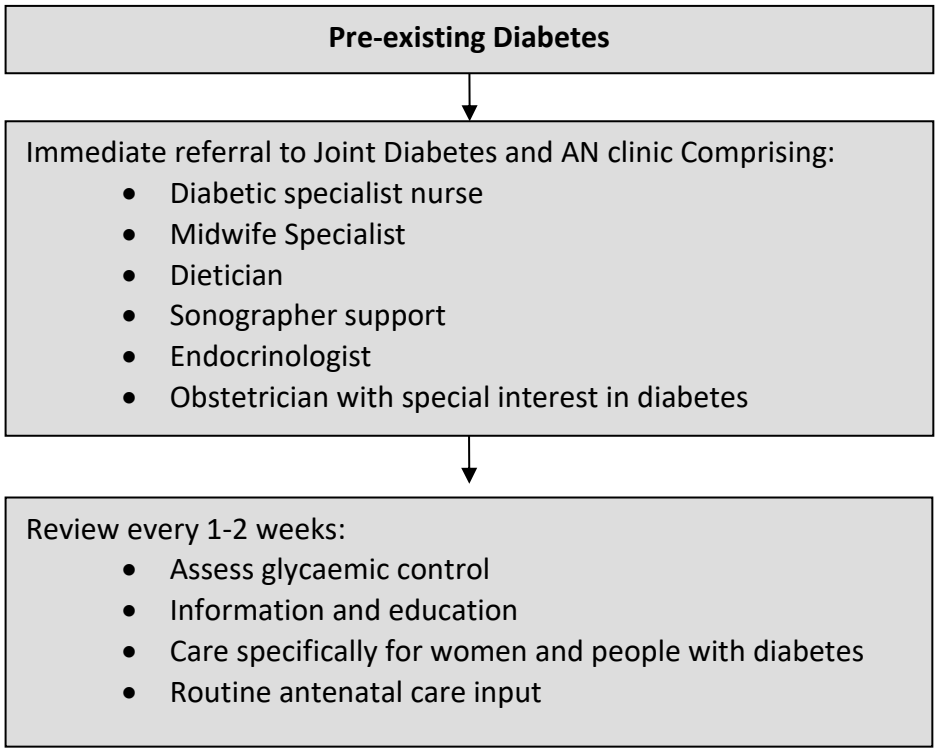
- Advise women and people with diabetes who are planning to become pregnant to defer rapid optimisation of blood glucose control until after retinal assessment and treatment have been completed.
- Request a renal assessment, including a measure of serum creatinine and urinary albumin: creatinine ratio

3 Antenatal

3.1 Risks of Pre-existing Diabetes in Pregnancy:

Maternal	**Fetal/ neonatal**
Hypos Deterioration of retinal/ renal function Infection Pre-eclampsia Birth trauma Induction of labour Caesarean section	Miscarriage Congenital malformation Stillbirth Prematurity Macrosomia Birth trauma Neonatal hypoglycaemia Neonatal death Obesity and/or diabetes in later life

3.2 All women and pregnant people are offered a pattern of antenatal care dependent on risk factors, and whether or not this is their first on going pregnancy. They should be referred to the joint Diabetes and AN clinic at PRH on Monday pm and at RSCH on Tuesday am where the following clinicians work as a team.



Timetable for Antenatal Appointments:

Soon as confirmed pregnant– 10 wks	USS	• Confirm viability of pregnancy and gestational age
	Booking	• Appointment (ideally by 10 wks)
	Discussion / education / information	• Commence Diabetes Care Record • Discuss information, education and advice about how diabetes will affect pregnancy, birth and early parenting (such as breastfeeding and initial care of the baby • Inform women and pregnant people with type 1 diabetes of the risks of hypoglycaemia and hypoglycaemia unawareness in pregnancy) • Offer retinal assessment for those with pre-existing diabetes unless they have been assessed in the last 3 months. • Take uACRArrange contact with the joint diabetes and antenatal clinic *every 1–2 weeks* throughout pregnancy for all women and pregnant people with diabetes. • Measure HbA1c levels for women and pregnant people with pre-existing diabetes to determine the level of risk for the pregnancy. • Advise women and pregnant people to take 150 mg of aspirin daily from 12 weeks until 36 weeks of pregnancy to reduce the risk of pre-eclampsia • **Documentation in the maternal notes of individualised management plan that covers pregnancy and postnatal period of up to 6 weeks**
16 wks	Retinal scan / assessment	• For women and pregnant people with pre-existing diabetes with signs of diabetic retinopathy at the first antenatal appointment.
20 wks	Cardiac USS	• **Offer USS four-chamber view of the fetal heart and outflow tracts**
	Anomaly scan	• Offer routine anomaly scan as in non-diabetic antenatal care
28 wks	USS	• Monitoring of fetal growth and amniotic fluid volume
	Retinal scan / assessment	• Offer to pre-existing diabetics who did not have diabetic retinopathy at their first antenatal clinic visit
	Investigations	• Offer investigations appropriate to women and pregnant people at 28 wks in routine antenatal care as well. Take HbA1c
32 wks	USS	• Fetal growth and amniotic fluid volume
34 wks	AN assessment	• As per routine care • Initial care of the baby • Initiation of breastfeeding and hand expressing advice. • Effect of breastfeeding on glycaemic control
36 wks	USS	• Fetal growth and amniotic fluid volume
	Information / education	• Timing, mode and management of birth (see box below) • Review and agreement of individualised management plan that covers labour, birth and postnatal period of up to 6 weeks • Changes to hypoglycaemic therapy during and after birth • Contraception and follow-up • Take HbA1c
38 wks	Delivery	• Advise pregnant women and pregnant people with type 1 or type 2 diabetes and no other complications to have an elective birth by induction of labour, or by elective caesarean section if indicated, between 37+0 weeks and 38+6 weeks of pregnancy
	Assessment	• As per routine care for women and pregnant people awaiting spontaneous labour

3.3 Targets for Glycaemic control and monitoring

- Pre-existing type 1 may have access to some form of flash monitoring. Offer CGM as per NICE guidance (2020) or continue with their preferred method of monitoring

- Advise women and pregnant people to test their fasting, pre-meal, 1 hour post-meal, and bedtime blood glucose levels daily during pregnancy
- Agree individualised targets for self-monitoring of glycaemic control
- Advise women and pregnant people to aim for a fasting blood glucose of 5 mmol/litre or less, and 1 hour postprandial blood glucose below 7mmol/litre.
- Reinforce how best to treat hypoglycaemia

3.4 Additional care for women and pregnant people taking insulin (Type 1 diabetes):

Offer:

- Glucagon and Glucogel to women and pregnant people with type 1 diabetes
- A ketone meter
- Insulin pump therapy if glycaemic control using multiple injections is not adequate and the woman or pregnant person experiences significant disabling hypoglycaemia.

Advise:

- **The risks of hypoglycaemia and hypoglycaemia unawareness in pregnancy, especially in the first trimester and document this advice in the maternal notes**
- Women and pregnant people and their partners or family members on the use of oral glucose solutions and glucagon for hypoglycaemia.

3.4.1 The presence of diabetic retinopathy should not prevent rapid optimisation of glycaemic control in women and pregnant people HbA1c in early pregnancy.

3.4.2 Thromboprophylaxis should be considered for women and pregnant people with nephrotic range proteinuria above 5 g/day (albumin:creatinine ratio greater than 220 mg/mmol)

3.4.3 Advise women and pregnant people to take 150 mg of aspirin daily from 12 weeks until 36 weeks of pregnancy to reduce the risk of pre-eclampsia

3.4.4 Advise women and pregnant people on the benefits of antenatal hand expressing and colostrum harvesting from 36 weeks.

3.4.5 Detecting and managing diabetic ketoacidosis:

Detection:

- Test urgently for ketonaemia if a pregnant woman or pregnant person with any form of diabetes presents with persistent hyperglycaemia (> 14mmol/l) or is unwell, to exclude diabetic ketoacidosis.
- Offer ketone testing strips and advise women and pregnant people to test their ketone levels if they are hyperglycaemic or unwell.

3.5 Management (*Appendix B*):

If diabetic ketoacidosis is suspected this should be treated as an emergency and there should be senior input at an early stage

- If at home transfer in by ambulance and following triage in A&E women and pregnant people should be immediately admitted for level 2 critical care (High Dependency Unit). The Consultant Obstetrician should be informed and either the on call Registrar or consultant attend to review the patient, discuss with the medical and diabetic team and make a multidisciplinary plan of care.
- If the woman or pregnant person is an inpatient the midwife should do an emergency referral to the on call obstetric registrar who should attend immediately. If the woman or pregnant person is collapsed there should be consideration for calling the MET (Medical Emergency Team) to attend. The woman or pregnant person should then be immediately admitted to HDU and the process followed as above.

3.6 Management of Women and pregnant people with MODY (Maturity Onset Diabetes of the Young)

- MODY is a genetic sub-group of diabetes characterised by autosomal dominant inheritance and early onset (HNF1a, HNF1b, HNF14a, Glucokinase, MIDD, neonatal diabetes), following genetic testing to confirm the diagnosis of monogenic diabetes.

Monitoring & Treatment

- All monitoring as with a woman or pregnant person with pre-existing diabetes
- Treatment as with a woman or pregnant person with pre-existing diabetes

Glucokinase -MODY

- For women and pregnant people with glucokinase mutation treatment is dependent on fetal growth. If normal fetal growth identified by ultrasound no additional treatment is required.
- For women and pregnant people with glucokinase mutation and accelerated fetal growth, insulin is to be considered and commenced with support of the woman or pregnant person.

HNF4A-MODY

- Fetal inheritance of the mutation leads to excessive fetal growth and increased risk of neonatal hypoglycaemia (due to fetal hyperinsulinism).

Continuous Subcutaneous Insulin Infusion (Insulin pump):

Women and pregnant people with type 1 diabetes are increasingly using insulin pump therapy which can also be used to safely achieve optimal glucose control during pregnancy, labour and delivery.

4 Delivery

- Advise women and pregnant people with diabetes to give birth in hospital where advanced neonatal resuscitation skills are available 24 hours a day.
- Once in established labour, check CBG hourly (target 4 – 7). Stop meal time insulin (and metformin if taken) but continue long acting basal insulin once VRIII is started.
- Do not use interstitial glucose monitoring on VRIII e.g. Freestyle Libre

- If CBG is less than 4.0 mmol/L, then treat hypoglycaemia as per Appendix A e.g. 5 level teaspoons glucose powder in water or 225mls Lucozade if can swallow, or 150mls of 10% glucose IV.
- Start VRIII in all women and pregnant people with type 1 diabetes using multiple daily injections at the time of established labour.
- Commence Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre as the substrate fluid with VRIII to avoid hypoglycaemia, hyponatraemia and hypokalaemia. The fluid should run at 50 ml/hr (the rate may have to be adjusted to the volume status of the patient).
- In women and pregnant people with type 2 diabetes or GDM, VRIII should be started if two consecutive blood glucose levels are above 7 mmol/L. The second CBG should be within half an hour of the first high reading to prevent any delay in starting VRIII.
- Check U+Es 4–6 hourly during labour to maintain potassium and bicarbonate.
- Recommend continuous electronic fetal monitoring (CTG).
- Women and pregnant people should be admitted to obstetric ward for delivery with a clear plan including a prescription chart from the antenatal clinic.

5 Spontaneous labour

- To continue with normal diet and insulin (unless on oxytocin infusion/ have an epidural)
- Do not stop long acting insulin as this will still have effect the next day
- When in established labour, commence VRIII and Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre infusion.

6 Induction of labour

- Advise pregnant women and pregnant people with type 1 or type 2 diabetes and no other complications to have an elective birth by induction of labour, or by elective caesarean section if indicated, between 37+0 weeks and 38+6 weeks of pregnancy
- Women and pregnant people to be admitted in the morning and given breakfast and normal dose of insulin.
- To continue with normal diet and insulin (unless on oxytocin infusion/ have an epidural)
- In established labour the VRIII should be commenced with a Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre infusion.
- If ARM start intravenous insulin with a Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre infusion with oxytocin infusion.
- If patient is on a continuous subcutaneous insulin infusion (CSII) – a discussion should be made prior to booking IOL whether the diabetes will be managed on the CSII or switched to an intravenous insulin infusion.

7 Elective LSCS – a.m.

- Administer normal night time insulin the night before delivery, on morning of surgery reduce basal insulin (Lantus, Levemir, Insulatard) to pre-pregnancy dose
- Omit oral hypoglycaemics (Metformin)

- If elective caesarean section is planned in the morning, a VRIII can be set up at about 6 a.m., or earlier if blood glucose levels are unstable overnight. Otherwise admit at 8am and commence intravenous infusion and insulin as per VRIII.
- Nil by mouth from 02:00 – if hypoglycaemic pre VRIII take 4 glucose tablets (equivalent of 20g glucose).

8 Emergency LSCS

- Commence substrate infusion and VRIII if not already in progress when possible until next meal.
- If general anaesthesia is used for the birth in women and pregnant people with diabetes, monitor blood glucose every 30 minutes until the mother/birthing parent is fully conscious.

9 Corticosteroids for fetal lung maturity

- Administration of steroids may result in a deterioration of glycaemic control for 2 to 3 days. This should be anticipated and actively managed.
- If a woman or pregnant person is admitted for corticosteroids for fetal lung maturity then an VRIII (variable rate intravenous insulin infusion – an insulin 'sliding scale') should be commenced prior to the first dose of steroids and continued for at least 12 – 24 hours after the last dose of steroids (only discontinue if blood glucose levels are within normal limits).
- Target blood glucose 4 – 7 mmol/L pre and post-meals
- If the VRIII is in addition to the normal insulin regimen and the woman or pregnant person is eating then there is no requirement for fluids. If the woman or pregnant person is not eating e.g. starved for a procedure, then an IVI of Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre should be used as per regime below (unless the blood glucose is very high i.e. above 14).
- Ketoacidosis can occur if blood glucose is not monitored regularly (hourly) and any increase treated.
- Do not use betamimetic medicines (Atosiban) for tocolysis in women and pregnant people with diabetes.
- Check U+Es prior to starting VRIII to monitor fluid balance and electrolyte abnormalities. Repeat 24 hourly.
- Women and pregnant people on insulin pump therapy may be able to safely maintain glycaemic control following steroid administration by use of correction boluses and temporary basal rate increases. In general approximately 40% increase in insulin doses may be needed. If optimal glycaemic control cannot be achieved (e.g. 2 consecutive blood glucose readings > 7.8 mmol/L), a variable rate intravenous insulin infusion (VRIII) may need to be considered. Continue basal insulin via pump.

9.1 Insulin and glucose regime

- Commence Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre as the substrate fluid with VRIII *, running at 125 ml/hour. Set up an infusion of human Actrapid (50 units made up to 50 ml with sodium chloride

0.9%) using the rate from the VRIII below. Both glucose and Actrapid infusions must be prescribed on drug chart.

- Hourly Capillary Blood Glucose (CBG) 'finger prick' – aim to maintain blood glucose at 4-7mmol/l.
- Insulin based on Variable Rate Intravenous Insulin Infusion (sliding scale) below. Start with Scale A, but if CBG maintained more than 7 move from Scale A to B to C as necessary. Use scale A up to 40units of insulin total daily dose all insulin, Scale B if on 41 – 80 total daily units of insulin, or scale C if on > 81 units of insulin daily.

BM (mmols/L)		**Dose of insulin (units/hour)**				**Actions**
from	to	Scale A	Scale B	Scale C	Scale D	
<3.5		0	0	0	0	Inform Doctor
3.6	4.5	0.5	0.5	0.5	0.5	
4.6	7	1	2	3	4	
7.1	9.0	2	4	5	6	Inform doctor if still > 7 for 3 consecutive hours and move up a scale
9.1	11	3	6	7	9	Inform doctor
11.1	14	5	8	9	11	Inform doctor
14.1	17	7	10	12	14	Inform doctor
>17.1		10	12	15	17	Inform doctor

*In some cases insulin without substrate fluids may have to be used (difficult i.v. access, fluid overload states, hyponatraemia or risk of hyponatraemia). Please consult senior medical/ obstetric staff as needed.

- Women and pregnant people with insulin pumps may prefer to use them whilst in labour.
- If the woman or pregnant person is unable to manage their own insulin needs, or becomes unstable, i.e. blood glucose >7.0 mmol/L on two consecutive occasions, or has urinary ketones ++ or more on urinary dipstick or high capillary blood ketones (> 1.5 mmol/L) then a VRIII should be commenced immediately. Their own insulin pump should remain in place on the basal settings; this will allow safe transition to their postnatal regimen.
- For a caesarean when insulin pump settings can be changed to post-partum doses by the woman or pregnant person or their partner just before the commencement of surgery.
- Women and pregnant people using continuous glucose monitoring (CGM) should also be reminded that capillary glucose tests are more accurate during labour and delivery.

10 Neonatal Care

10.1 Neonatal hypoglycaemia results from excessive insulin production in the fetus as a result of maternal hyperglycaemia and glucose transfer through the placenta. This can result in increased neonatal insulin production after delivery leading to neonatal hypoglycaemia. By contrast, babies of mother/birthing parents with normal glucose tolerance have a slow insulin response resulting in higher glucose levels after birth. Fetal hyperinsulinaemia may not only be because of high glucose level during labour but may also have its origin in poor diabetes control during pregnancy.

10.2 The baby should stay with the mother/birthing parent unless extra neonatal care is required.

10.3 Do not discharge babies into community until they are maintaining their blood glucose level and feeding well.

10.4 Admit babies of anyone who had diabetes in their pregnancy to the neonatal unit if they have:

- Hypoglycaemia, which is defined as a blood glucose less than 2.6 mmol/L, and are symptomatic or are unwell or not feeding
- Severe hypoglycaemia which is a blood glucose under 1.8 mmol/L
- Respiratory distress
- Signs of cardiac decompensation from congenital heart disease or cardiomyopathy
- Signs of neonatal encephalopathy
- Signs of polycythaemia and are likely to need partial exchange transfusion
- Need for intravenous fluids
- Need for tube feeding (unless adequate support is available on the postnatal ward)
- Jaundice requiring intense phototherapy and frequent monitoring of bilirubinaemia
- Been born before 34 weeks (or between 34 and 36 weeks if dictated clinically by the initial assessment of the baby and feeding on the labour ward).

10.5 Carry out blood glucose testing routinely in babies of women and people with diabetes at 2–4 hours after birth. The BSUH neonatal hypoglycaemia pathway advises 1st blood glucose at 4 hours and then 8 and 12 hours.

10.6 Ensure early feeding of the baby (within 30 minutes of birth) and at 2-3 hourly intervals (see MP069 Care of Newborn Immediately after Birth, MP072 Newborn Feeding.)

11 Post-Partum

- Following delivery maternal insulin requirements rapidly return to pre-pregnancy doses.
- Follow the individualised management plan in the woman or person's notes for a 4 weeks postnatal period.

11.1 **Type 1 Diabetes**

- Insulin requirements drop immediately after delivery.
- Following delivery of the placenta the insulin infusion rate should be reduced by 50% in women and people with type 1 and type 2 diabetes. Continue hourly monitoring until the first meal, insulin is not usually required with the first light meal after delivery.

- Stopped VRIII 30-60 minutes after the first meal. Pre-pregnancy diabetes regimen should be resumed once eating and drinking. The doses should be as pre-advised by diabetes team (or 25% less than early pregnancy doses).
- Women and people with pre-existing diabetes should resume their usual pre-pregnancy monitoring regimen. Aim for 6 – 10 mmol/L to avoid hypoglycaemia.
- If breastfeeding encourage healthy eating with increased carbohydrate as recommended for all women and people in order to establish lactation. Up to 450 extra calories per day may be needed when feeding is fully established. Advise women and people to snack (10-15 g carbohydrate) and drink each time they feed or express milk (including night feeds). If bottle feeding encourage healthy eating without any need for additional calories or carbohydrate.
  Women and people with type 1 diabetes should be screened for post-partum thyroiditis with a TSH at 3 and 6 months postpartum

11.2 **Patients on insulin pump:**

If they haven't already done so, the woman or person must change the pump settings to their postnatal settings as described on the individual care plan provided by the diabetes team. If the woman or person's pump has been discontinued it should be re-connected for one hour prior to discontinuing the VRIII. Only discontinue VRIII when the woman or person feels able to manage their own pump. In the absence of a documented individual care plan, ensure the woman or person changes their pump following the advice below:

- 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 4 mmol/L
- Blood glucose targets should be increased to 6-10 mmol/L

11.3 **Type 2 Diabetes on oral treatment before pregnancy**

- Stop insulin when the placenta is delivered.
- Continue 4-hourly blood glucose monitoring (until first meal)
- Subsequent blood glucose monitoring: Pre-meals and pre-bedtime aim for 6 – 10 mmol/L to avoid hypoglycaemia.
- Return to usual pre-pregnancy oral glucose lowering drugs if on metformin or glibenclamide. Other oral glucose lowering drugs should be discussed with the diabetes team. Metformin does not cause hypoglycaemia.
- Women and people can resume or continue taking metformin and glibenclamide while breastfeeding.
- Encourage healthy diet choices with low GI diet plus weight management advice as applicable.

Section 2: Gestational Diabetes

1 Antenatal

Risks of Gestational Diabetes in Pregnancy:

Maternal	Fetal/ neonatal
Birth trauma Induction of labour Caesarean section Diabetes in later life	Macrosomia Neonatal hypoglycaemia Obesity and/or diabetes in later life

1.1 Women and pregnant people who have previously had GDM need and HbA1c at booking and a GTT at 14 and 26 weeks.

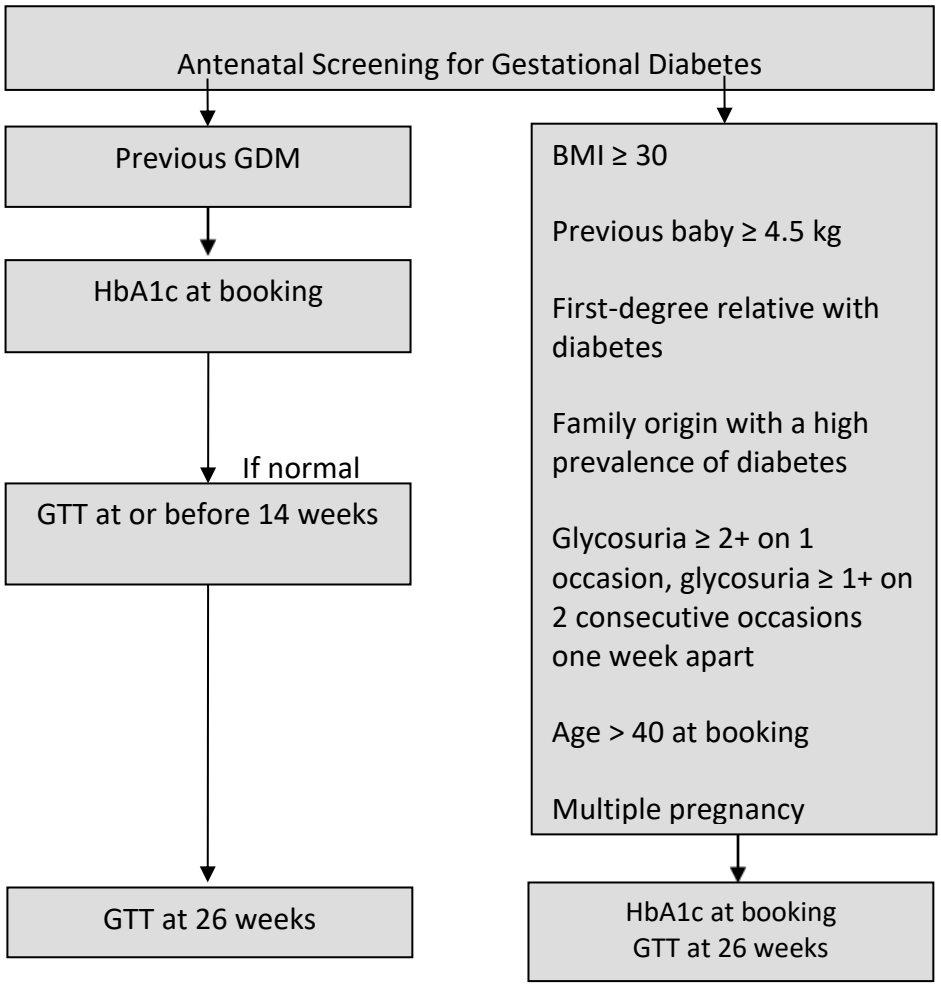
1.2 All women and pregnant people in certain higher risk groups should be tested for gestational diabetes.

1.2.1 The following risk factors at booking should prompt an Hba1c at booking and a GTT at 26weeks (between 24 and 28 weeks):

- BMI above 30 kg/m²
- Previous macrosomic baby ≥ 4.5 kg
- Previous gestational diabetes (see 3.1.3)
- Family history of diabetes (first-degree relative with diabetes)
- Over 40 years of age
- Multiple pregnancies
- Family origin* with a high prevalence of diabetes:
  - South Asian (India, Pakistan, Bangladesh)
  - Black African/Caribbean
  - Middle Eastern (Saudi Arabia, United Arab Emirates, Iraq, Jordan, Syria, Oman, Qatar, Kuwait, Lebanon or Egypt)
  - Mauri/pacific Islander

*Anybody who does not have two parents of white European ancestry recommend an oral glucose tolerance test (OGTT) – If both parents are of white European ancestry then no OGTT) - if in any doubt about this please contact the antenatal diabetes team for advice.

1.3 Antenatal Screening flow chart:



1.4 Women and pregnant people who have had previous gestational diabetes should be offered testing (an oral glucose tolerance test or early self-monitoring of blood glucose) as soon as possible after booking and if normal again at 24-28 weeks gestation. Women and pregnant people with any of the other risk factors for gestational diabetes should be offered screening at 24-28 weeks gestation.

1.5 Women and pregnant people who have had bariatric surgery (but not pre-existing diabetes) and meet the high risk categories above will need to be taught capillary blood glucose monitoring if they are not able to have a glucose tolerance test.

1.6 A GTT should be arranged at any time if a woman or pregnant person is found to have glycosuria ≥ 2+ on 1 occasion, glycosuria ≥ 1+ on 2 consecutive occasions one week apart at any gestation up to 36 weeks, or current macrosomia/ polyhydramnios

1.7 After 36 weeks an HbA1c should be taken. If 39 or over they should be referred to the diabetes team and seen in the next available clinic.

1.8 Risk factors for gestational diabetes include increased weight gain in early adulthood, smoking, previous stillbirth, polycystic ovary syndrome, antipsychotics – discuss with an Obstetric Consultant.

1.9 Procedures for performing diagnostic screening tests:

GTT:
1) Advice to give to woman or pregnant person before test: • They must attend appointment fasted for 10 hours (water only) • They should not smoke over the same period prior to the test • Bring something to eat/drink (for after the test) • Bring a book or magazine 2) First blood sample taken (1x grey-topped vacutainer bottle) 3) Woman or pregnant person drinks glucose drink – (113mls Polycal made up to 250mls with water) 4) Wait for 2 hours (can have sips of water / can pass urine / should not leave department) 5) Second blood test after the 2 hours (1x grey-topped vacutainer bottle)
Diagnose gestational diabetes if the woman or pregnant person has either: • **A fasting plasma glucose level ≥ 5.6 mmol/l (first sample)** **or** • **A 2 hour plasma glucose level ≥ 7.8 mmol/l (second sample)** **Refer to the Joint Diabetes and Antenatal Clinic as soon as possible after diagnosis of gestational diabetes**

1.10 Antenatal Care - Diagnosed Gestational Diabetes

Abnormal GTT at any stage of pregnancy

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Immediate referral to Joint Diabetes and AN clinic Comprising:
- Diabetic specialist nurse
- Midwife Specialist
- Dietician
- Sonographer support
- Endocrinologist
- Obstetrician with special interest in diabetes

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Review every 1-2 weeks:
- Assess glycaemic control
- Information and education
- Care specifically for women and people with diabetes
- Routine antenatal care input
- Monitoring of fetal growth and amniotic fluid volume at 28, 32, 36 weeks

1.11 Targets for Glycaemic control and monitoring

- Advise women and pregnant people to test blood glucose levels fasting and 1 hour after every meal during pregnancy.
- Advise women and pregnant people to aim for a fasting blood glucose of 5mmol/litre or less and 1 hour postprandial blood glucose below 7mmol/litre.

1.12 Additional care for women and pregnant people with Gestation Diabetes:
Commence Diabetes Care Record at diagnosis
Explain that:

- In some women and pregnant people, gestational diabetes will respond to changes in diet and exercise
- The majority of women and pregnant people will need oral blood glucose-lowering agents or insulin therapy
- That good blood glucose control throughout pregnancy will reduce the risk of serious adverse birth complications such as fetal macrosomia, trauma during birth (for them and their baby), induction of labour and/or caesarean section, neonatal hypoglycaemia and perinatal death
- A diagnosis of gestational diabetes will lead to increased monitoring, and may lead to increased interventions, during both pregnancy and labour

1.13 Refer all women and pregnant people with gestational diabetes to a dietician.

1.14 Advise women and pregnant people with gestational diabetes to take regular exercise (such as walking for 30minutes after a meal) to improve blood glucose control).

1.15 Offer a trial of changes in diet and exercise to women and pregnant people with gestational diabetes who have a fasting plasma glucose level below 7mmol/litre at diagnosis.

1.16 Offer metformin to women and pregnant people with gestational diabetes if blood glucose targets are not met using changes in diet and exercise within 1–2 weeks.

1.17 Offer addition of insulin to the treatments of changes in diet, exercise and metformin for women and pregnant people with gestational diabetes if blood glucose targets are not met.

1.18 Offer immediate treatment with insulin, with or without metformin, as well as changes in diet and exercise, to women and pregnant people with gestational diabetes who have a fasting plasma glucose level of 7.0 mmol/litre or above at diagnosis.

1.19 Measure HbA1c levels in all women and pregnant people with gestational diabetes at the time of diagnosis to identify those who may have pre-existing type 2 diabetes

1.20 Advise women and pregnant people on the benefits of antenatal hand expressing and colostrum harvesting from 36 weeks.

2 Delivery

2.1 Advise women and pregnant people with uncomplicated gestational diabetes to give birth no later than 40+6 weeks.

2.2 Monitor plasma glucose hourly during labour and birth in all women and pregnant people with diabetes, ensuring it is maintained between 4 and 7 mmol/L.

2.3 Women and pregnant people should be admitted to obstetric ward for delivery with a clear plan.

3 Spontaneous labour

3.1 Do not give Metformin in labour

3.2 Women and pregnant people on diet/ metformin who are not on a VRIII may still be able to use the pool with intermittent auscultation

3.3 Continue with normal diet (unless on oxytocin infusion/ have an epidural)

3.4 When in established labour, blood glucose level should be tested hourly.

3.5 Commence VRIII and **Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre running at 125ml/hr via Baxter pump** if already on insulin, for those women and pregnant people on diet/ metformin commence VRIII if glucose is above 7 mmol/l on two consecutive occasions.

3.6 Women and pregnant people needing a VRIII should have continuous electronic fetal heart rate monitoring.

4 Induction of labour

4.1 Women and pregnant people to be admitted in the morning, if not had breakfast provide, and give normal dose of insulin.

4.2 To continue with normal diet and treatment

4.3 In established labour blood glucose level should be tested hourly, commence VRIII and **Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre at 125ml/he via baxter** if capillary blood glucose is above 7 mmol/l, or straight away if already on insulin.

5 Elective LSCS – a.m.

5.1 Administer normal night time treatment the night before delivery.

5.2 Nil by mouth from 02:00 – if hypoglycaemic pre VRIII take 4 glucose tablets (equivalent of 20g glucose).

5.3 Admit at 8am and commence intravenous infusion of glucose and insulin as per VRIII if glucose is above 7 mmol/l

6 Emergency LSCS

6.1 Commence VRIII and Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre running via baxter at 125ml/hr until delivery if glucose is above 7 mmol/l if possible.

7 Corticosteroids for fetal lung maturity

7.1 If a woman or person on insulin is admitted with threatened pre-term labour or premature rupture of membranes and given corticosteroids for fetal lung maturity, then an VRIII should be commenced prior to the first dose of steroids and continued for 12 - 24 hours after the last dose of steroids (only discontinue if blood glucose levels are within normal limits).

7.2 If the VRIII is in addition to the normal insulin regimen and the woman or pregnant person is eating then IVI not required. If they are not eating e.g. starved for a procedure, then an IVI of **Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre running at 125ml/hr via Baxter** should be used as per regime below (unless the blood glucose is very high i.e. above 14).

7.3 Women and pregnant people receiving steroids prior to a planned caesarean before 38+6 should:

7.3.1 Diet Controlled: Self-monitor 2 hourly at home for 12 hours if treated `and to come in if above 7mmol/l.

7.3.2 On Metformin: Women and pregnant people should be admitted to the antenatal ward for 2 hourly self-monitoring until 12 hours after last dose, and a VRIII if > 7mmol/l on two consecutive occasions.

7.3.3 On insulin: Women and pregnant people should be admitted to the delivery suite for VRIII and hourly monitoring.

8 Insulin and glucose regime

8.1 Hourly blood glucose (finger prick):

8.1.1 Aim to maintain blood glucose at 4-7mmol/l,

8.1.2 Set up an infusion of Potassium chloride 0.15% (potassium 20mmol/1litre) / Glucose 4% / Sodium chloride 0.18% infusion 1litre*, running initially at 125 ml/hour

8.1.3 Set up an infusion of human Actrapid (50 units made up to 50 ml with - sodium chloride 0.9%) using the rate from the Variable Rate Intravenous Insulin Infusion (sliding scale) below.

8.1.4 Both glucose and Actrapid infusions must be prescribed on drug chart.

8.1.5 Start with Scale A

8.1.6 If Capillary Blood Glucose (CBG) remains more than 7 move from Scale A to B to C to D as necessary.

8.1.7 Start scale A up to 40 units of insulin total daily dose all insulin, Scale B if on 41 – 80 total daily units of insulin, scale C if on 81-120 units of insulin daily, or scale D if >120 units per day

BM (mmols/L)		Dose of insulin (units/hour)				Actions
from	to	Scale A	Scale B	Scale C	Scale D	
<3.5		0	0	0	0	Inform Doctor
3.6	4.5	0.5	0.5	0.5	0.5	
4.6	7	1	2	3	4	
7.1	9.0	2	4	5	6	Inform doctor if still > 7 for 3 consecutive hours and move up a scale
9.1	11	3	6	7	9	Inform doctor
11.1	14	5	8	9	11	Inform doctor
14.1	17	7	10	12	14	Inform doctor
>17.1		10	12	15	17	Inform doctor

*In some cases insulin without substrate fluids may to be used (if eating and drinking, difficult i.v. access, fluid overload states, hyponatraemia or risk of hyponatraemia). Please consult senior medical/ obstetric staff as needed.

9 Neonatal Care

9.1 The baby should stay with the mother/birthing parent unless extra neonatal care is required

9.2 Carry out blood glucose testing in babies at 4 hours after birth. The neonatal hypoglycaemia pathway advises 1st blood glucose at 4 hours and then 8 and 12 hours.

9.3 Ensure early feeding of the baby (within 30 minutes of birth) and at 2-3 hourly intervals (see MP069 Care of Newborn immediately after Birth, MP072 Newborn Feeding.)

9.4 Do not discharge babies into community until they are at least 12 hours, maintaining their blood glucose level and feeding well.

9.5 Admit babies of women and people with diabetes to the neonatal unit if they have:

9.5.1 Hypoglycaemia, which is defined as a blood glucose less than 2.6 mmol/L, and are symptomatic or are unwell or not feeding

9.5.2 Severe hypoglycaemia which is a blood glucose under 1.8 mmol/L

9.5.3 Respiratory distress

9.5.4 Signs of cardiac decompensation from congenital heart disease or cardiomyopathy

9.5.5 Signs of neonatal encephalopathy

9.5.6 Signs of polycythaemia and are likely to need partial exchange transfusion

9.5.7 Need for intravenous fluids

9.5.8 Need for tube feeding (unless adequate support is available on the postnatal ward)

9.5.9 Jaundice requiring intense phototherapy and frequent monitoring of bilirubinaemia

9.5.10 Been born before 34 weeks (or between 34 and 36 weeks if dictated clinically by the initial assessment of the baby and feeding on the labour ward).

10 Postnatal

10.1 Stop VRIII at delivery.

10.2 Monitor CBG before and 2 hours after meal for 24 hours. The targets are 6.0mmol/L fasting and 7.8mmol/L two hours after meals. If out of this range continue testing and advise follow up with GP. If concerned about higher readings then postnatal staff can contact the diabetes team for advice.

Encourage healthy diet choices with low GI diet plus weight management advice as applicable.

10.3 Offer an HbA1c test 6 - 13 weeks after the birth to exclude diabetes (for practical reasons this might take place at the 6-week postnatal check).

10.4 Advise on the risks of gestational diabetes in subsequent pregnancies and screening for diabetes when planning pregnancy.

10.5 Offer lifestyle advice (including weight control, diet and exercise.)

10.6 Offer an annual HbA1c test to women and people who were diagnosed with gestational diabetes who have a negative postnatal test for diabetes.

11 Documentation

11.1 The term ‘units’ should be used for insulin measure in all context. Abbreviations such as ‘U’ or ‘IU’ should never be used.

11.2 Accurate documentation is essential. All staff involved should provide written documentation of actions undertaken within the maternity notes.

11.3 Documentation should include: evidence and involvement of a multi-disciplinary team, timetable of antenatal appointments, offering an antenatal ultrasound examination of the four chamber view of the fetal heart and outflow tracts at 20 weeks

11.4 Including an individual management plan in the maternity records that covers the pregnancy and postnatal period.

12 References

1) NICE (2015) *Diabetes in pregnancy: Management of diabetes and its complications from pre-conception to the postnatal period.* London: NICE. www.nice.org.uk
2) Nice Quality Standard QS109 https://www.nice.org.uk/guidance/qs109
3) MBRRACE-UK Perinatal Confidential Enquiry Report (Nov 2015) www.npeu.ox.ac.uk/mbrrace-uk/reports
4) National Pregnancy in Diabetes (NPID) Audit Report, 2014, Health and Social Care Information Centre (Nov 2015) www.hscic.gov.uk
5) Diagnostic criteria and classification of hyperglycaemia first detected in pregnancy World Health Organization (WHO) 2013
6) Management of glycaemic control in pregnant women and pregnant people with diabetes on obstetric wards and delivery units, JBDS-IP, May 2017
7) NICE (2020) Diabetes in pregnancy: management from preconception to the postnatal period

Appendix A - How to manage low blood glucose (hypoglycaemia)

Hypoglycaemia – diagnosed as blood glucose <4.0mmol/l + / - symptoms

All patients who are on insulin or a sulphonylurea (eg. gliclazide, glibenclamide*) should have Glucagon 1mg im prescribed on PRN section of main drug chart

MILD/MODERATE

IF PATIENT AWARE AND CAN SWALLOW

↓

Give quick-acting carbohydrate, ideally 5 level teaspoons glucose powder in water or 225mls Lucozade or glucose tablets (give number of tablets equivalent to 20g carbohydrate).

↓

Monitor Blood Glucose at 10-15 minute intervals If glucose not increased and patient remains symptomatic, repeat quick-acting carbohydrate until BG>4 mmol/l. If still hypo after 3 successive doses of quick acting carbohydrate, call doctor.
Verify capillary glucose result with venous blood

↓

As symptoms improve and blood glucose has increased give long acting carbohydrate e.g. slice of bread or 1 glass milk+1 biscuit or main meal if due

SEVERE

IF PATIENT UNCONSCIOUS OR UNRESPONSIVE

↓

Call Medical Emergency Team - 2222

↓

If has intravenous (IV) access (give into large vein)

Start with 150mls of 10% glucose IV
(Repeat after 10 minutes if glucose still below 4 mmols/)l

If no IV access - Give 1mg Glucagon IM*

↓

As symptoms improve and patient is sufficiently awake to swallow, give long acting carbohydrate as for mild / moderate hypoglycaemia.
If conscious level remains impaired consider other cause, for example stroke

Following a hypoglycaemic episode:

- ***Glucagon will be ineffective in patients with severe liver disease or starved patients. It may also be less effective in patients with sulphonylureas, and IV glucose should be treatment of choice in these clinical situations.**
- When patient is completely oriented and blood glucose is staying above 5.0mmol/l return to previous regularity of blood glucose monitoring. Be aware, the patient may be susceptible to further episodes of hypoglycaemia
- If IM glucagon was given double the amount of long acting carbohydrate
- If hypoglycaemia has occurred just before they are due their next dose of insulin or oral anti-hyperglycaemic medication, having treated the hypoglycaemia as above, **give** their prescribed diabetes medication
- **Unless otherwise instructed do not omit any current diabetes medication. Request review of medication by Diabetes Advice Team.**
- If patients are experiencing recurring episodes of 'hypos' please refer to the Diabetes Medical Team or contact the Diabetes Specialist Nurses

Written by Diabetes In-Patient Care Committee (DIPCC)

Appendix B - Diabetic Ketoacidosis (DKA) Care Pathway

These guidelines are based upon the Joint British Diabetes Societies In-patient care Groups consensus document *http://www.diabetologists-abcd.org.uk/JBDS_DKA_Management.pdf*.
For a fuller account follow link to *Diabetic Ketoacidosis*. Below is a practical guide to management.

Diabetic Ketoacidosis is a medical emergency with a significant morbidity and mortality. It should be diagnosed promptly and managed intensively. The specialist diabetes team should always be involved as soon as possible and ideally within 24 hours because this has been demonstrated to be associated with a better patient experience and reduced length of stay.

For young people under the age of 18 years, discuss with the paediatric diabetes service, suitability for management by paediatricians will depend on local arrangements and the physical maturity of the individual.
The BSPED DKA guidelines can be found at:
http://www.bsped.org.uk/professional/guidelines/docs/DKAGuideline.pdf

Assessment of Severity

The presence of one or more of the following may indicate severe DKA and admission to a level 2/HDU (High Dependency Unit) environment, insertion of a central line and immediate senior review should be considered:

- Blood ketones over 6 mmol/L
- Bicarbonate level below 5 mmol/L
- Venous/arterial pH below 7.1
- Hypokalaemia on admission (under 3.5 mmol/L)
- GCS less than 12 or abnormal AVPU scale
- Oxygen saturation below 92% on air (assuming normal baseline respiratory function)
- Systolic BP below 90 mmHg
- Pulse over 100 or below 60 bpm
- Anion gap above16 **[Anion Gap = (Na+ + K+) – (Cl- + HCO3-)]**

Provision of care

DKA patients should be managed on Medical Assessment Unit unless ITU/HDU care deemed appropriate. Nursing staff appropriately trained in Level 2/HDU should take the lead in hands on patient care.

General Principles

In general fixed rate insulin administration rates are preferred. However, reliance on standard variable rate intravenous insulin infusion (IVII) regimens may fail to accommodate for the very obese or the pregnant patient and risks premature reduction of insulin dosage. Insulin administration by weight allows insulin resistant states to be accommodated. The insulin infusion rate is calculated by weight, which may need to be estimated.
Where blood ketone measurements are available the adequacy of the insulin regimen is determined by the rate of fall of the ketones and will need revision if this is inadequate. If bedside ketone measurement is not

available the bicarbonate level can be used to assess response during the first 6 hours, but may be less reliable thereafter. This is particularly important when glucose levels are relatively normal. Supplementary glucose solution may need to be infused at some stage in treatment to provide substrate. This will permit the fixed rate IVII to be maintained, avoid hypoglycaemia and allow the full suppression of ketone production. For detailed management of DKA please see hospital policy.