الهيئة الليبية للبحث العلمي
Libyan Authority for Scientific Research

الجمعية الليبية للسكري
LIBYAN DIABETES ASSOCIATION
We Care
LDA

وزارة الصحة

الجمعية الليبية للسكري

الدليل الارشادي الوطني

لتشخيص وعلاج سكر الحمل

2029-2025

Clinical Practice Guidelines For Management Of Hyperglycemia In Pregnancy : An Expert Consensus Statement From The Libyan Diabetes Association (LDA)

اعداد : اللجنة الاستشارية العلمية
بالجمعية الليبية للسكري

مقدمة

يعتبر داء السكري من اكبر التحديات الصحية عالميا حيث يزداد عدد المرضي المصابين بالسكر عالميا مستنزفا للموارد البشرية والمادية ما يشكل عباء علي الانظمة الصحية في العالم نتيجة للاستهلاك الحاصل لتوفير الرعاية الطبية والادوية وعلاج المضاعفات الخطيرة الناجمة عن مرض السكر مثل الجلطات القلبية والدماغية , فقد ان البصر,لفشل الكلوي, القدم السكرية و بتر الاطراف وكدلك المخاطر علي الام الحامل والجنين . ووفقا لاحصاءات اطلس العاشر للاتحاد الدولي للسكري فان عدد المصابين بالسكري في العالم يناهز 537 مليون مصاب ويقدر ان يصل عدد المصابين العام 2045 إلى 630 مليون ، مع ازدياد الشرائح العمرية الدي يصيبها مرض السكري اي بنسبة 8% من سكان العالم .

كما ورد في الدراسة الاستقصائية للمسح الوطني في ليبيا لسنة (2022-2023) ان نسبة انتشار مرض السكر الفعلي تصل الي 14.9% من السكان البالغين في ليبيا اذا ما اضيف اليه ضاهرة ارتفاع السكر علي الريق 15.6% فان ارتفاع معدلات السكري بلغت 30.5% من البالغين وهدا يجعل السكري احد الامراض المزمنة الاكثرشيوعا في ليبيا. مما يستوجب توفير امكانات ضخمة للخدمات الصحية وتنيسق جهود العاملين في المجال وعلي راسها الوصول الي راي موحد متفق عليه مبني علي الادلة العلمية والمناسبة لخصوصيات مجتمعنا لعلاج ومنع انتشار المرض و مضاعفاته .

عليه فانه من دواعي سرورنا ان تشارك الجمعية الليبية للسكري في اصدار الدليل الارشادي لمرض السكر لمعرفة اخر التوصيات العلمية لطرق العلاج والوقاية من مضاعفات السكر علي مريضة السكري الحامل وجنينها .كخطوة اساسية في استراتيجيات وزارة الصحة تهدف إلى توحيد الممارسات الصحية المتعلقة بالسكري على المستوى الوطني¡ وتقديم إطار عمل شامل لتقديم الرعايةالصحية للمراة الحامل المصابة بالسكري حيث ان هدا العمل العلمي المميز هو نتاج جهود خيرة لمجموعة من الاساتدة من ابناء الوطن فان التوصيات صممت بما يتماشي مع النظام الصحي محليا ابحيث يمكن تطبيقه. وارجوان يؤدي هدا الدليل الارشادي دوره في مساعدة الاطباء علي متابعة التوصيات الحديثة لعلاج سكر الحمل واشكر كل من ساهم في اعداد هده الارشادات العلمية وسنسعي لوضعها قيد التنفيد . وبارك الله اعمالكم .

والسلام عليكم ورحمة الله

د. محمد الغوج

وكيل عام وزارة الصحة المكلف بمهام الوزير

كلمة الجمعية الليبية للسكري

الدليل الإرشادي الوطني لسكر الحمل للعام 2025 هو وثيقة تتضمن إرشادات وإجراءات للتشخيص المبكر لسكري الحمل في ليبيا ولمعرفة اخر التوصيات العلمية لطرق العلاج والوقاية من مضاعفات السكر علي مريضة السكري الحامل وجنينها . يهدف الدليل الإرشادي الى توحيد الممارسات الصحية المتعلقة بالسكري على المستوى الوطني ، وتقديم إطار عمل شامل لتقديم الرعاية الصحية للمراة الحامل المصابة بالسكري . يُعَدّ فرط سكر الدم أثناء الحمل سواء أكان ناجمًا عن داء سكري موجود مسبقًا (Pre-existing Diabetes) أو عن اصابة حديثة بالسكر اثناء الحم(GDM) Gestational diabetes من التحديات الصحية الكبرى التي تواجه رعاية الحوامل في ليبيا والعالم.

ترتبط الإصابة بالسكري أثناء الحمل بمضاعفات خطيرة منها الإجهاض، مقدمات الارتعاج ، Preeclampsia الإملاص , (Stillbirth) التشوهات الخلقية ، إصابات الولادة ، والوفيات المحيطة بالولادة للأ م والطفل . كما يمكن أن يؤدي الحمل إلى تدهور سريع في اعتلال الشبكية السكري لدى النساء المصابات مسبقًا، مما يستلزم مراقبة متخصصة ودقيقة خلال فترة الحمل .

يُعد فرط سكر الدم داخل الرحم عامل خطر مهم في برمجة صحة الجنين المستقبلية ، حيث يرفع من احتمالات إصابته بالسمنة، وارتفاع ضغط الدم ، والسكري من النوع الثاني في مراحل لاحقة من الحياة .

كل هدا يُشكل خطرًا حقيقيًا على صحة الأم والجنين،تشير التقديرات إلى أن ما يقرب من 87.5% من حالات الحمل المعقدة بالسكري ناتجة عن سكري الحمل ،GDM بينما تعود 7.5% إلى السكري من النوع الأول، و 5% إلى النوع الثاني.

ويُعد هذا التوزيع مؤشراً على الأهمية المتزايدة للكشف المبكر والمتابعة الدقيقة لحالات سكري الحمل ضمن برامج الرعاية التوليدية .وفي هذا السياق، أعدّت جمعية السكري الليبية هذا الدليل الوطني الإرشادي بهدف :

- توحيد الممارسات و تقديم مرجعية موحدة للممارسات السريرية المثلى في تشخيص وإدارة فرط سكر الدم أثناء الحمل، استنادًا إلى أفضل الأدلة العلمية المتاحة ، ومراعية للخصوصية السكانية والنظام الصحي الليبي.
- تعزيز الكشف المبكر عن سكري الحمل من خلال الفحص المنهجي لجميع الحوامل.
- توفير آليات موحدة لتقييم الخطورة ، وتحديد أهداف التحكم بسكر الدم أثناء الحمل .
- التعريف باهمية وجود عيادة مشتركة تشمل كل من اخصائي السكر واخصائي النساء والولادة لتقديم افضل نصيحة علاجية للسيدة الحامل المصابة بالسكري .
- دعم القرارات العلاجية المتعلقة بالتدخلات الغذائية والدوائية ، بما في ذلك استخدام الأنسولين والعلاجات الأخرى.

- إرشادات حول العلاج الدوائي¡ والنظام الغذائي¡ وممارسة الرياضة، وكيفية التعامل مع مضاعفات السكري.

- توعية المجتمع لزيادة الوعي بمرض السكري وأهمية الوقاية منه¡ وتوعية المرضى بكيفية التعامل مع حالتهم .

- تحسين نتائج الحمل وتقليل المضاعفات قصيرة وطويلة الأمد على كل من الأم والمولود , مما سينعكس على جودة حياة مريض السكري من خلال توفير الرعاية الصحية اللازمة

بشكل عام : يمثل الدليل الإرشادي الوطني لسكري الحمل في ليبيا 2025 مرجعًا أساسيًا للعاملين في مجـــال الرعاية الصـحية والمرضى على حد سواء، ويهدف إلى تحسـين مسـتوى الرعاية الصـحية المتعلقة بمرض السكري في ليبيا.

أ. د. نجوي محمد رحيم

رئيس الجمعية الليبية للسكري

أعضاء اللجنة العلمية المشاركون في كتابة الدليل الإرشادي الوطني لتشخيص وعلاج مرض السكر والحمل:

رؤساء اللجنة

نجوي رحيم
(استشاري الباطنة والغدد الصماء والسكر)

كمال أبوقليلة
(استشاري الباطنة والغدد الصماء والسكر)

الأعضـــــــاء :

محمد سلـــطـــان / استشاري طب النساء والتوليد

نـجـاة ابـو زيـــد / استشاري الباطنة والغدد الصماء والسكر

اسماء ياسين عريبي / استشاري طب النساء والتوليد

فايزة المهدي هنـــدر / استشاري الباطنة والغدد الصماء والسكر

عبد القادر المصـري / استشاري التغذية العلاجية والسكري

عديلة العـمـامي / استشاري الباطنة والغدد الصماء والسكر

سهـير جـابـر جـابـر / استشاري الباطنة والغدد الصماء والسكر

سعاد عمران عثمان / استشاري طب النساء والتوليد

ابتسـام حـديـد / استشاري غدد وسكر الأطفال

سعاد احمـد المداح / استشاري طب الأطفال وحديثي الولادة

الهيئة الليبية للبحث العلمي
Libyan Authority for Scientific Research

LIBYAN DIABETES ASSOCIATION
LDA

Advisory board for the LDA clinical practice guide lines consensus group Chair persons:

1. NAJUA M.RHAYEM (Chair): consultant physician and endocrinologist &Libyan Diabetes Association president : n.rhayem@uot.edu.ly

2. Kamal Abouglila (CO-Chair) :Consultant physician and endocrinologist. kamaldlin@yahoo.com Honorary member LDA

CONTRIBUTORS:

1. Najat Omer Buzaid : consultant physician and endocrinologist,7-Th October Hospital Benghazi- Libya . najat.buzaid@uob.edu.ly

2. Mohamed Sultan : professor of Obstetrics & Gynecology, Faculty of Medicine, University of Tripoli, Tripoli, Libya. Moh.Sultan@uot.edu.ly

3. Asthma M Y Arebi, : professor of Obstetrics and Gynaecology, Faculty of Medicine, University of Tripoli,Tripoli, Libya. asmayarebi@yahoo.co.uk

4. Faiza almehdi hander: consultant physician and endocrinologist at endocrine department ,Tripoli university hospital. drhanderfaiza@gmail.com

5. Abdulgader Almasri : consultant therapeutic nutrition anddiabetes .Nokba hospital ,Tripoli ,Libya. Aalmasri1966@gmail.com

6. Adela.H.Elamami :professor of medicine at Department of Medicine.,Faculty of Medicine, Benghazi University,benghazi , libya . Adela.ebsat@uob.edu.ly

7.Suhir Gaber A Gaber : consultant at Al-Kish Center for Specialized Clinics ,benghazi ,libya . j.suhair@yahoo.com

8. Soad omran Otman: professor of Obstetrics and Gynaecology, Faculty of Medicine, University of Tripoli,Tripoli, Libya soadotman@gmail.com

9. Ibtessam haded, consultant pediatrition Pediatric endocrine department Tripoli university hospital,tripoli,libya .ibtisamhadeed1@gmail.com

10. Soad Ahmad Almadah, consultant Pediatric neonatology department Tripoli university.soad666835@gmail.com

Clinical Practice Guidelines For Management Of Hyperglycemia In Pregnancy (HIP): An Expert Consensus Statement From The Libyan Diabetes Association (LDA)

Article in press Libyan Medical Journal- LMJ , copy wrights preserved

* On behalf of the Libyan Diabetes association

Address For Correspondance : Najua M.Rhayem ,
Department of Medicine ,Faculty of Medicine ,University of Tripoli,Tripoli ,Libya
Diabetes Endocrine Hospital Tripoli ,)MOH(Tripoli,Libya
Head of Task Force Committee ,LDA president .
Email: n.rhayem@uot.edu.ly
ORCID number :0009-0009-9657-1353

Abstract

Hyperglycemia in pregnancy)HIP(, whether it is a preexisting diabetes or gestational diabetes (GDM), poses a significant risk to both maternal and fetal health. HIP is associated with preterm labour, fetal macrosomia and neonatal hypoglycemia. Universal blood glucose screening at booking helps in identifying women with hyperglycemiain pregnancy (HIP) .Women who screen negative at first antenatal visit should be subsequently screened with a fasting oral glucose tolerance test (OGTT)around 24-28 weeks to identify GDM. Effective management of hyperglycaemia during pregnancy is crucial to reduce complications.Early risk assessment, individualized glycaemic targets, lifestyle interventions,and pharmacological therapy all will improve maternal and neonatal outcomes, while reducing long-term health risks.The Objective of the Libyan diabetes association consensus guidelines is to provide a clinical practice guidelines for the management of hyperglycemia in pregnancy.This consensus is made after reviewing various existing guidelines including National institute of Clinical Excellence, American Diabetes Association, American College of Obstetricians and Gynecologists, Royal college of Obstetricians and Gynecologists. A literature search was done using Pub Med ,Cochran Database,Google Scholar,EMBASE, various system reviews, and original articles .Establishing a clear evidence-based guidelines for management HIP is essential to ensure optimal health outcomes. A structured approach to screening, monitoring, and treatment can help mitigate complications and provide better support for expectant mothers.

Introduction

The Middle East and North Africa (MENA) region has the highest age adjusted prevalence of diabetes which is 12.2 %. The prevalence of HIP is very high in the IDF-MENA region It is 17.9% in Women whoare 20- 29 years of age ; 15.8 % live births are affected by GDM(1).

The prevalence of diabetes in pregnancy has been increasing in Libya in parallel with the world wide epidemic of obesity.Not only is the prevalence of type1 diabetes (T1D) And type 2 diabetes (T2D)increasing in individuals of reproductive age but there is also a dramatic increase in the reported rates of GDM (1)Approximately 87.5% of pregnancies complicated by diabetes are estimated to be due to GDM (which may or may not resolve after pregnancy), with 7.5% being due to T1D and the remaining 5% being due to T2D (2).

Diabetes in pregnancy is associated with risks to both the woman and the developing fetus.

Miscarriage, pre-eclampsia, preterm labour and stillbirth are more common in women with pre-existing diabetes,as well as congenital malformations, macrosomia ,birth injury, perinatal mortality and post natal problems such as hypoglycaemia. In addition, diabetic retinopathy can worsen rapidly during pregnancy.Maternity services must ensure implementation of robust processes to manage the risks associated with preexisting diabetes. In addition, exposure to hyperglycemia in utero increases the risks of obesity, hypertension, and type 2 diabetes in off spring later in life (3,4).

Objective

The aimof this practical guideline is to ensure that evidence-based information and best practice guidance is available for all staff involved in caring for women with Diabetes during pregnancy, the intrapartum and postpartum period.To address the diversity and non uniformity of screening, diagnosis, and management of HIP in Libya ,the president of the Libyan Diabetes Association Dr.Najwa Rhayem assigned a scientific committee in September 2024 for the development of the Libyan Guidelines under the Chair person of Dr Kamal Abouglila ,which Comprised members from different disciplines of Diabetes, Endocrinology,Obstetrics Gynaecology,Paediatrics and Neonatology with a strong intellectual, clinical, and research background and possessing expertise and interest in diabetes during pregnancy. Different subsections to the author's HIP guidelines were distributed among 12 participating members. There were about 10 physical and virtual meetings every weekend, and each lasted 2–3 h with active participation of the members. The first meeting started in November 2024 and after 3 months, by the end of January 2025 the guidelines were completed and ready for publication.

Each member of the guideline team was assigned to author one or multiple subsections of the HIP guidelines.The sections were then reviewed by all members in these multiple weekly virtual meetings, and a consensus of expert opinion was achieved. Editing and internal review was done by a group of four members.Finally, the Chair of the guideline committee with the in-depth research and intellectual input cooperationof team members has been able to produce pragmatic evidence, and practice-based guidelines on HIP for Libyan health care teams. This was successfully completed in a short period of 6 months.

Keeping in view the rapidly evolving medical evidence, the guidelines are proposed to be updated after four years.there was no funding available, this work was completed on a purely voluntary basis.

1.PRE-CONCEPTIONCARE FOR WOMEN WITH TYPE 1 OR 2 DIABETES

Starting at puberty, and continuing in all women with diabetes and child bearing age preconception counseling should be incorporated into routine diabetes care.Family planning should be discussed, and effective contraception (with consideration of long- acting, reversible contraception) should be prescribed and used until an individual's treatment plan and A1C are optimized for pregnancy (2-4).Preconception counseling should address the importance of achieving glucose levels as close to normal ,ideally A1C < 6.5%. to reduce the risk of congenital anomalies, pre-eclampsia, macrosomia, preterm birth and other complications. (2-4). Womenwith a history of GDM should seek preconception screening for diabetes and preconception care to identify and treat hyperglycemia and prevent congenital malformations.In addition to focused attention on achieving glycemic goals, A Standard preconception care Should be augmented with extra focus on nutrition, physical activity,diabetes self-care,education, and screening for diabetes comorbidities and complications.Womenwith preexisting diabetes who are planning a pregnancy or who have become pregnant should be counseled on the risk of development and/or progression of diabetic retinopathy. Dilated eye examinations should be done ideally before pregnancy as well as in the first trimester, and then pregnant women should be monitored every trimester, and for 1 year postpartum as indicated by the degree of retinopathy, and as recommended by an ophthalmologist .Women with diabetes should be advised by the Diabetes team to avoid an unplanned pregnancy and be encouraged to seek advice when planning a pregnancy. Whenwomen with diabetes are planning a pregnancy, information provided should cover :

- Roleof diet, body weight and exercise.
- Goodglycaemic control before conception and throughout pregnancy will reduce, but not eliminate, the risk of miscarriage, congenital malformation, stillbirth and neonatal death.
- Risks of hypoglycaemia during pregnancy.
- Increased risk of having a baby who is large for gestational age, which increases the likelihood of induction of labour, instrumental and caesarean section deliveries
- Babyhas an increased risk of admission to a neonatal unit.
- Needfor diabetic retinopathy and nephropathy assessment before and during pregnancy.

1.1 Pre-conceptual optimisation of glycaemic control

• Refer to preconception clinic .
• Strongly advise against pregnancy if HbA1c ≥ 10 %.
• Establish glycaemic control with HbA1c assessment.
• Measure monthly until target value of < 6.5% is achieved.
• Advise any reduction in HbA1c may reduce risks but pregnancy should definitely be avoided with levels ≥ 10%(2).
• Review medication:
o If taking Metformin this should be continued.
o Other oral hypoglycaemic agents should be stopped.
• Stop the administration of statins, angiotensin-converting enzyme inhibitors(ACE), and angiotensin-II receptor antagonists ,and consider alternative antihypertensives.
• Advise Folic Acid 5mg and arrange prescription.And to be continued until 12 weeks gestation.
• Use isophane insulin)NPH(as the first choice for long-acting insulin during pregnancy. Consider continuing treatment with long-acting insulin analogues (insulin detemir or insulin glargine) for women with diabetes who have established good glycemic control before pregnancy (2).
• If using insulin discuss hypoglycemia. Provide Glucagon kit an glucogel.
• Offer blood ketone testing strips for women with T1D.
• Advise referral to the Specialist Dietitian for Diabetes.
• Encourage continued self-monitoring of blood glucose (SMBG) and agree individualised targets.
• Ensure retinal screening.
• Conduct acomprehensive renal assessment including micro albuminuria, kidney function test and estimated glomerular filtration rate(eGFR).Refer to a nephrologist before discontinuing contraception if:
o Serum creatinine is > 1.36 mg/dl or
o eGFRisless than 45ml/minute/1.73m^2

2. Gestational Diabetes (GDM)

Universal screening for HIP is recommended for all pregnant women at the booking visit. The recommended test is the one-step 75 g 2-h OGTT using IADPSG criteria (International Association Diabetes and Pregnancy Study Groups) (5).

2.1 When to test BG

Screening for HIP should be done at the first antenatal visit (preferably in the first trimester). For
women with normal glucose values on initial screening, a sequential screening is recommended at the
24th to 28th weeks of gestation. A third-trimester BG testing should be done if the first two trimesters
screening was missed, especially for women belonging to a high-risk group who develop clinical
features suggestive of HIP (Figure 3).

2.2 Target population

Universal screening of all pregnant women is recommended, irrespective of risk factors to be offered at booking visit.

2.3 Blood glucose screening options

- Therecommended standard test is a one-step 75 g 2-h OGTT using IADPSG criteria.
- Alternative option: If the pregnant woman cannot come in fasting state, then the non-fasting 75 g 2-h OGTTby Diabetes in Pregnancy Study Group of India (DIPSI) method may be used(5).
- BGlevelof >180 mg/dL after 1 hour is taken as the cut off for the diagnosis of GDM
- BGIfthepregnant woman cannot tolerate the glucose load or in case glucose is not available, fasting blood glucose (FBG, defined as no caloric intake for at least 8 h) can be done at the first antenatal visit or later in pregnancy.
- HbA1cis not recommended as a BG screening test for GDM.

2.4 Screening Methodology for oral glucose tolerance test (OGTT).

- Avenous blood sample is taken after 8 h of fasting. Overall, 75 g glucose is dissolved in 250 mL of water and the woman is asked to drink it over 3–5 min.
- Avenous blood sample is taken at 1 h and 2 h after a 75 g glucose load see Appendix 1

Recommendations prior to OGTT :

- Rationale should be discussed in ANC.
- Appointment is made for the first ANC visit, and a letter with information is given to the woman. The woman is advised to:
- Have a normal diet for 3 days prior to the test.
- Nofood from midnight before the test. Water only.
- Nosmoking is advised until completion of the test.
- Essential medications only before GTT eg labetalol , levothyroxine. Withhold ferrous sulphate, pregnancy vitamins etc.
- If steroids have been given in the antenatal period and an OGTT is required consider delaying the OGTTuntil one week after steroids initiation.

Appendix 1 : Procedure for Oral Glucose Tolerance Test

- Ensure woman has fasted as instructed.
- Explain the test.
- Obtain fasting venous blood sample.
  The woman is instructed to drink 300 mls of Rapilose)this is available a tamper proof sealed packet; it does not require measuring out(. This should all be drunk within 5 minutes.
  Obtain a venous blood sample 1 and 2 hours after drinking the Rapilose.
- Incase rapilose is not available , three ampules of 50% dextrose may serve as a viable alternative; as each ampule of 50% dextrose comprises 25 grams of glucose.

- Advise women to bring food and drink for consumption following the procedure.
- Document on medical records.
- Inform the patient that she will be contacted if an abnormal result is found

2.5 Diagnosis of GDM (IADPSG) tolerance test (OGTT).

GDM is confirmed if the woman has either of the blood glucose readings (table1)

Table1: The IADPSG criteria for diagnosis of GDM

Blood glucose values	mg/dL	mmol/L
Fasting	92	5.1
1 h	≥ 180	≥ 10
2 h	≥ 153	≥ 8.5

FBG after 8h of fast, with or without HbA1c test, may be used for women who cannot tolerate oral glucose load. If the FBG level is between 92 and 125mg/dL , women may be considered as having GDM.

- DIPSI Method: (Non-fasting OGTT): 75 g of glucose is dissolved in 250 mL of water.
- The woman is asked to drink it over 3–5 min, irrespective of the time of the last meal.
- Preexisting DM is diagnosed when one or more BG values are above cut-off values based on WHOandADAcriteria:
- FBG:≥126 mg/dL
- Randomblood glucose (RBG): ≥200 mg/dL
- HbA1C:≥6.5%

HbA1c test

HbA1c test is performed during the first trimester to identify women with preexisting diabetes and to assess the risk to pregnancy.

- HbA1cvalue ≥6.5% is diagnostic of preexisting diabetes.
- It is not recommended for the screening and diagnosis of GDM.
- It is not a reliable test during the second or third trimesters since physiological changes in pregnancy and anemia may lower HbA1C values.

Womenwith a diagnosis of GDM will be reviewed by specialist diabetes and obstetrics team with special interest in diabetes within a week of diagnosis.

2.6 Previous Gestational diabetes

• All women with GDM ina previous pregnancy will be referred, and they will be reviewed in a consultant clinic to discuss choice of care in pregnancy. Women will be offered either :
• Tobetreated as having GDM in this pregnancy and commence blood glucose monitoring or
• Tohave an OGTT atbooking and a further OGTT at 24- 28 weeks if the result of the first OGTT is normal (2,4).
• Women whochoose to be treated as having GDM during this pregnancy will be referred to the speacialist diabetes and obstetric Team ,given an anti-natal clinic follow up appointment in the Diabetes Obstetric Antenatal clinic.

2.7 Other categories:

2.7.1 Women with previous bariatric surgery with risk factors for gestational diabetes are not suitable for OGTT due to the risk of dumping syndrome.

• Instead offer a fasting blood glucose between 26+0 and 28+0 weeks; and show them how to record blood glucose levels over a period of a week.
• Following self-monitoring, results must be reviewed by the Diabetes team and a decision is made regarding follow up care. If indicative of gestational diabetes, the woman will be transferred into the Diabetes Obstetric Antenatal Clinic for ongoing diabetes review.

2.7.2 Presence of glycosuria in women who have had a negative OGTT at 26-28 weeks

▪ Womenwhohavealready had a negative OGTT at 26-28 weeks, and have risk factors identified at booking namely glycosuria (1+ on two occasions and 2+ on one occasion)with no other concerns with growth or Amniotic fluid index (AFI) do not require an additional OGTT, But same women with some concerns with growth or AFI should receive a further OGTT and referred to diabetes Obstetric Antenatal Clinic if required.

2.8 late presentation(gestational age between 30-35 weeks):

- Patients receiving HAART)Highly Active Antiretroviral Therapy(for HIV(6)
- Womenontheantipsychotic medications Haloperidol, Chlorpromazine, Sulpiride, Flupenthixol, Zuclopenthixol, Clozapine, Olanzapine, Risperidone or Quetiapine
- Previous unexplained stillbirth.
- Estimated fetal weight above 90th centile and/or abdominal circumference > 95th centile on ultrasound scan.
- Polyhydramnios.
- Glycosuria 2+ on one occasion or 1+ on two occasions.

(No need for OGTT, they should be offered 1 week self monitoring of blood glucose andreviewed in the clinic after that and if there is > 25 % elevation of blood glucose reading consider GDM.)consensus opinion).

2.9 Risk for hyperglycemia in pregnancy

- Maternal obesity.
- Familyhistory of DM in first-degree relative.
- Advancedmaternal age ≥35 years.
- Autoimmune disease.
- Chronichypertension.
- Useofmedication that is diabetogenic)e.g. systemic corticosteroids(.
- Previous macrosomic baby weighing ≥4 kg.
- Previous GDM.
- Recurrent pregnancy losses.
- Unexplained still birth.
- Badobstetric history.
- Fetal anomaly.
- Largeforgestational age LGA baby (AC ≥90th centile or estimated fetal weight ≥90th centile)
- Polyhydramnios.
- Glycosuria 2+ on one occasion or >1+ on more than two occasions.

3.0 Current recommended glycemic and blood glucose targets:

3.1 Finger stick capillary blood glucose (CBG) targets (table 2)

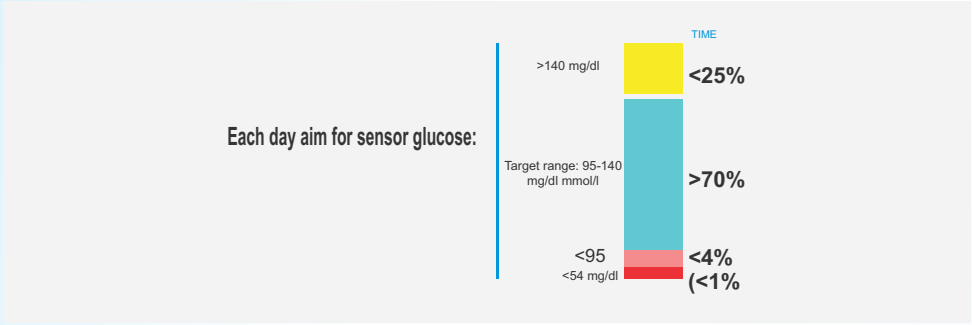
Table-2 : Finger stick capillary blood glucose (CBG) and HBA1C targets

Fasting CBG	70-95 mg/dl
1 hour after meals CBG	110-140 mg/dl
2 hour after meals CBG	100-120 mg/dl
Maintain CBG	> 70 mg/dl
HbA1C	< 6%

3.2 Continuous glucose monitoring (CGM) targets:

- Sensorglucose 95-140 mg/dl at least 70% of the time (>16 h 48 min per day)
- Sensorglucose > 140 mg/dl less than 25% of the time (< 6 h per day)
- Sensorglucose < 95 mg/dl less than 4% of the time (< 1 h per day)
- including sensor glucose < 54 mg/dl less than 1% of the time (<15 min per day)

Glycemic targets in CGM were based on NICE guidelines, glycemic targets for HIP and studies that proved favorable outcome of CGM in pregnancy (2,7,8)



4. Antenatal care of Women with GDM
5. Appointments for ANC are with the multidisciplinary team consisting of Obstetricians, Diabetes team, and Diabetes Educators.

- Consultant care and delivery in an obstetric unit

4.1 First clinic consultation, explain to the women the management plan:

- Self-monitoring of blood glucose daily and targets levels.
- The fact that treatment includes changes in diet and exercise, and may involve medications.
- Ahealthy diet during pregnancy.
- The fact that regular exercise (such as walking for 30 minutes after a meal) improves blood glucose control.
- The fact that good blood glucose control throughout pregnancy will reduce the risk of:

o Fetal macrosomia
o Trauma during birth)for the mother and baby(
o Induction of labour and /or Cesarean section
o Neonatal hypoglycaemia and perinatal death

- Blood investigation: HbA1c to exclude preexisting diabetes.
- The fact that follow up will occur the next week in the Joint Diabetes Antenatal Clinic

•Following initiation of blood glucose monitoring if targets are not met with medical nutritional therapy and exercise, women may require Metformin and/or insulin to achieve the target blood glucose levels.
• Offer metformin if 3 or more out of 7 fasting levels are above target within 1 to 2 weeks.
• Offer insulin instead of metformin if metformin is contraindicated or not tolerated by the woman.
• Offer addition of insulin to changes in diet, exercise and metformin for women with GDM if blood glucose targets are still not met.
• Rapid acting insulin analogues (NovoRapid® insulin aspart, Fiasp, Lyumjev and Humalog® insulin lispro) are safe to use in pregnancy and have advantages over soluble human insulin during pregnancy (9-13).
• Use Isophane)NPH(insulin as the first choice for long acting insulin in pregnancy. Consider continuing treatment with long acting insulin Detemir, Glargine or Tresiba in women who have established good blood glucose control before pregnancy(12,13)
• Long-acting insulin analogues, glargine and detemir, appear safe with similar maternal and fetal outcomes compared to neutral protamine Hagedorn (NPH) insulin.
• Consider basal bolus insulin regimen for the management of hyperglycaemia rather than Mix insulin because they offer both better blood control and more flexibility in adjustment of insulin doses.
• Consider glibenclamide for women with GDM:
In whom blood glucose targets are not achieved with metformin but who decline insulin therapy or Who cannot tolerate metformin.or situation where insulin is not available or declined by the patient and in poor socio economic conditions .

4.2 Medical nutrition therapy

It is a customised dietary plan for diabetes and HIP for optimum glycemic control and long-term fetal andmaternal well-being. Taking into consideration multiple factors such as BMI, glycemic control, personal and sociocultural preferences, patterns of eating, and financial constraints while planning meals/snacks .
*Recommended gestational weight gain and caloric requirements:(14-17)-Women with HIP should consume adequate calories and gain weight as recommended.
-Weight gain in the first trimester should be 0.5–2 kg.-No increase in caloric intake is recommended during the first trimester.-An additional 340 kcal/day is recommended during the second trimester.-An additional 452 kcal/day is recommended during the third trimester.-In women with polycystic ovarian disease (PCOS) weight monitoring should be fortnightly-Maintain minimum 1600-1800 kcal/day.

4.2.1 Carbohydrates

●Theminimumrequirement of carbohydrates is approximately 175 g/day. Overall, 35%–45% oftotal calories should come from carbohydrates.
● Spreadcarbohydrate-containing foods throughout the day.
12
● Balance protein with carbohydrates, as a pure protein meal may cause hypogly cemia in people taking insulin.

●Avoidsevere caloric restriction in pregnancy, especially in TID, as it may promote ketosis, which is associated with adverse effects on the fetal brain and nervous system.

4.2.2 Oils and fats

Overall, 25%–35% calories per day should come from fats. Do not exceed >40% of total calories.

4.2.3 Protein

- Daily requirement index(DRI) in pregnancy is a minimum 71 g of proteins daily.
- At least 20% of the calories should come from protein.
- Chicken, fish, egg white, low/no fat dairy, beans, lentils, and nuts are healthy sources of protein and should be evenly distributed in the meal plan.
- Protein supplements do not improve pregnancy outcomes.
- Proteins minimum 71 g/day 20%–25% of daily calories intake .

4.3 EXERCISE AND PHYSICAL ACTIVITY

Pregnancy provides a unique opportunity to motivate women for exercise.It facilitates glucose entry into the muscles, improves glycemic control,and reduces excessive weight gain during pregnancy and in the postpartum period.Women should be evaluated for obstetric and medical complications before advising them to indulge in exercise. Tailor exercise according to physical endurance and increase the intensity of exercise gradually if there are no obstetric or medical contraindications. Exercise should be done for 30–60 min daily (at least three to five days/week)with correct posture.Exercise time should be split preferably into 10- to 15-min intervals. Exercise preferably post-meal; if not tolerated, shift to pre-meal. The intensity of physical activity must be gauged, and it must not exceed the recommended limit . Treatment of GDM with the aim of achieving target glucose levels has been demonstrated to improve perinatal outcomes. Glycemic targets for GDM are similar to those for pre gestational T1Dor T2D.Women with GDMinwhomglycemic targets have not been achieved with diet and lifestyle; pharmacological therapy should be added in the form of Metformin and/or insulin (18).

4.4 Indications of medical therapy:

Consider insulin, with or without Metformin, in addition to diet and exercise for the following (2,3,19,20)

1. Women with GDM whohave a fasting plasma glucose level between 108 mg/dL and 125 mg/dL .
2. Presence of complications such as macrosomia or poly hydraminios.
3. As the first-line of treatment in women with GDM who have a fasting BG level of >126 mg/dL or a 2-h post- OGTT BG level >200 mg/dL.
4. If target glucose levels are not achieved within one to two weeks of starting Metformin.

4.4.1 Insulin therapy in GDM.

• If insulin is indicated, the type and timing of insulin should be guided by the results of SMBG with the aim of achieving target BG levels while avoiding hypoglycemia.
• Regular human insulin can provide satisfactory meal time coverage if injected about 20–30 min before the meal The rapid-acting insulin analogues, Lispro and Aspart are safe in pregnancy.The advantages of the rapid-acting analogues over regular human insulin is that they can be injected immediately before the meal due to their quick absorption and rapid onset of action and their better control of postprandial hyperglycemia.

• Basal insulin analogues are expensive as compared with regular insulin. If the fasting glucose levels are high, add a bedtime dose of intermediate-acting human NPH insulin or long-acting basal insulin analogues, for example, Detemir.

• If postprandial glucos elevels are above the target, start short-acting human regular insulin or one of the rapid-acting insulin analogues Lispro or Aspart before a meal.

•Consider a full basal-bolus insulin regime with three doses of regular human insulin or rapid-acting analogue before each of the three meals and NPH or Detemir as basal insulin oncedaily, as indicated by the results of SMBG (2,3,19,20).

4.4.2 Metformin

• Metformin crosses the placenta but there is no evidence for increased congenital anomalies,lower incidence of neonatal hypoglycemia, and less maternal weight gain when compared with insulin.
•Start Metformin at a dose of 500mg once or twice daily after meals andi ncrease gradually to the required maximum dose.
•Most patients derive maximum benefit from a total dose of 2000mg/day.
•Use either the immediate or the slow-release form.
•Avoid Metformin in women with a serum creatinine level>1.36mg/dl.

5.0 Antenatal Appointments See table3

Table3: time table of the clinic appointments for women with GDM

GESTATION	With whome	ACTION
12-16 weeks (early diagnosis)	Diabetes Specialist team	Discuss implications of GDM. Importance of good glycaemic control to reduce risk of macrosomia,trauma at birth, Induction of labour/ LSCS, neonatal hypoglycaemia, and perinatal death. Discussion of treatment includes changes in diet and exercise, and could involve medications. Information leaflets are given.Target levels explained, given contact details.All women should be encouraged to take regular

		exercise e.g. 30-minute walk after a meal to improve blood glucose control. All women to be given a blood glucose monitor and glucose reading diary.
1week following group session	Diabetes Team Obstetrician	Blood glucose review.
		Advice given medication if required. Discuss risks.
20 weeks	Diabetes Team Obstetrician	Antenatal, intrapartum and postnatal care pathway explained.
24 weeks	Diabetes Team	BG review.
24-26 weeks	Diabetes/ Obstetrics team	Arrange serial growth scans if not following a current pathway.
28 weeks	Diabetes Team Obstetrics	Blood glucose review. Routine ANC and blood tests. Anti D if applicable. Growth scan review if required.
32 weeks	Diabetes Team Obstetrics	BG review. Review growth scan. Routine AN care as required.
34 weeks	Diabetes / Obstetrics team	Routine AN care.
36 weeks	Diabetes Team Obstetrics/Mid wife	BG review and follow up management as required. Routine AN care. Time/mode of delivery planned. Diabetes birth plan.

5.1 Assessment of Fetal Growth

- Women diagnosed with gestational diabetes with no other risk factors for growth restriction should be offered a growth scan at 32 and 36 weeks gestation.
- Women with GDMandother risk factors should follow the serial scan pathway (Index2).

5.2 Timing and Mode of Delivery

▪Timing and mode of birth should be discussed with all pregnant women with diabetes during antenatal appointments, especially during the third trimester. (2)

▪ Womenwithwell controlled and uncomplicated GDM on diet or metformin should be advised to give birth by induction of labour or (if indicated) by caesarean section no later than 39 weeks.

▪ WomenwithGDMwhohavematernalor fetal complications e.g macrosomia, poor glycemic control and use of insulin therapy should give birth at around 37-38 weeks.

▪ For women with GDMwhohavean ultrasound diagnosed macrosomic fetus, the risks of vaginal birth should be discussed and advised to give birth by Caesarean section at 37-38 weeks .

5.3 Intrapartum Care of Gestational Diabetes

The care plan and management is tailored according to the woman's individual needs. It will be recorded on the medical record and will document the diabetes management plan for delivery which is agreed at the 36 weeks clinic appointment (21).

5.4 Induction of Labour.

- Blood glucose monitoring and treatment will continue as per pregnancy regime.
- The aimfor blood glucose levels between 72-144 mg/dl as this decreases the incidence of neonatal hypoglycaemia and fetal distress.
- The woman is offered continuous Electronic Fetal Monitoring during labour.
- Hourly Blood Glucose monitoring in established labour is recommended.
- Informed VRIII)variable rate intravenous insulin infusion(during labour is recommended if blood glucose levels become unstable e.g if blood glucose levels are above 144 mg/dl for two consecutive hours.

Index 2 : Management of Women with Polyhydramnios and/or accelerated growth at 34 weeks

PATHWAY FOR MANAGEMENT OF ACCELERATED FETAL GROWTH AND/OR POLYHYDRAMNIOS ON SCAN, GLYCOSURIA AND MISSED OGTT AFTER 34 WEEKS↓
Sonographer or obstetric team to refer to diabetes team within 7 days for home bloodglucose testing for 5 days. ↓
Diabetes team to review blood glucose readings and woman to be seen in Joint diabetes/antenatal clinic if readingsare outside the normal range (fasting>95mg/dl, one hour post prandial>140mg/dl) If readings with in range,no further glucose testing needed and woman to be reviewed by primary obstetric team for a management plan.
* Macrosomia is defined as Estimated Fetal Weight (EFW) more than 90th centile. OGTT is no tavalidated test for third trimester.5-10 days of Home Blood Glucose Monitoring (HBGM) is a better alternative as it gives a wider picture of glycemic control.This is evidence level C. *One pr eprandial and three postprandial blood glucose readings to be monitored daily.

5.4.1 WomenwithGDMoninsulin

- Womenwhoarenotonmultipledailydosesofinsulin)backgroundandrapidactinginsulin formeals(shouldnotrequireaVRIIIfordelivery.
- Womenwhodonotinitiallyrequire VRIIIbuthave2consecutivehourlybloodglucose levelsabove144mg/dlshouldbeadvisedtocommenceVRIIIifclinicallyappropriate. Ifsyntocinonisrequiredduringlabour,ensureitisdilutedwithnormalsalineand infusedthroughaseparateline.Donotgivefurtherglucoself VRIIIrequired,referto)table4).

Table 4:Guidance for Setting up a VRIII during labour: (50 units S insulin in 49.5mL 0.9% NaCl via syringe driver). Flash or CGM glucose levels should not be usedfor insulin dosing during VRIII.

Algorithm→	1	2	3
FingerprickBG Levelsmg/dl	Formost women	For women not controlled on algorithm1or needing>80 units/dayof insulin	For women not controlled on algorithm 2 (after specialist a dvice)
	InfusionRate(units/h=mL/h)		
<90.0	STOP IN SULINF OR 20 MINUTES If<72mg/dlTreat hypo as per guide line (re-check BG in 10 minutes)		
90-99	0.2	0.5	1.0
100-126	0.5	1.0	2.0
127-153	1.0	1.5	3.0
154-200	1.5	2.0	4.0
201-252	2.0	2.5	5.0
253-306	2.5	3.0	6.0
307-360	3.0	3.5	7.0
>361	3.5	4.0	8.0

الهيئة الليبية للبحث العلمي
Libyan Authority for Scientific Research

LIBYAN DIABETES ASSOCIATION

ALGORITHM GUIDE
• ALL women with diabetes should have Blood Glucose (BG)or intermittent or real time continuous glucose monitoring(CGM) testing hourly in established labour ,after ARM or on admission for elective C-Section • Start VRII land Fluids if two consecutive BG/CGM>target (seebelow) Algorithm 1Most women will start here Algorithm 2U se this algorithm for women who are likely to require more insulin (on steroids; on>80unitsof insulin during pregnancy;or those not achieving target on algorithm1) Algorithm 3 Use this for women who are not achievin gtarget on algorithm2(No patient starts here without diabetes or medical review) If the woman is not achieving targets with these algorithms,contact the diabetes team
Target BG level=72-126mg/dl
Check BG every hour whil ston VRII land every half an hour if under anaesthesia
Move to the higher algorithm if the BG is above target and is not dropping
Fluid to be used in pregnancy: - 500ml 5% dextrose in 0.9% saline (NaCl) with 20mmol potassium Choloride (kcl) via ivac. - Aim to keep potassium (k) between 4.0-5.0mmol/L.Check U+Es daily to ensure not hyponatraemicespecially when on Oxytocin.infuse at 50mls/hour
Move to the lower algorithm if BG falls below 72mg/dl or is dropping too fast

Dosing algorithm derived from NICE The recommended substrate fluid to be administered alongside the VRIII is 500mls 5% glucose in 0.9% saline (NaCl) 20mmol/L(at50mls/hr. Additional intravenous fluids may be required as per clinical neede.g. haemorrhage. VRII without substrate fluid may be Required some cases e.g. fluid overload, hyponatremia and pre-eclampsia.Pure dextroseContaining fluids should be avoided due to the risk of hyponatremia (21-23).

5.4.2 Elective Caesarean Section for Women with diet or metformin controlled GDM

- If currently managed with Metformin to have as prescribed the evening before Caesarean section.
- Morning list: fast from mid night
- Afternoon list: fast following light breakfast up to 7 AM
- VRIII not required

5.4.3 Elective Caesarean Section for Women with GDM on Insulin:

- Insulin as prescribed the night before.
- Morning list: fast from midnight.
- Afternoon list: fast following light breakfast up to 7 AM. If managed with meal time insulin omit breakfast insulin dose,
- Blood glucose prior to section - if blood glucose 144 mg/dl commence VRIII prior to theatre.

6.0 Postnatal GDM Management

Postnatal management is discussed by the diabetes team at 36 weeks in the Joint Diabetes Clinic

- Lifestyle advice to reduce risks of developing Type 2 diabetes
- fasting plasma glucose test at the 6-week postnatal check Or an HbA1c if after 13 weeks
- annual HbA1c due to continued risk factor for developing Type 2 diabetes
- There is increased risk of diabetes in future pregnancies

6.1 Following delivery

- Discontinue metformin and/or insulin and VRIII, if used, immediately after delivery
- Perform random monitoring of blood glucose levels prior to discharge to exclude persisting hyperglycaemia which may indicate undiagnosed type 1 diabetes.
- Women with blood glucose levels > 200 mg/dl should be reviewed prior to discharge by the diabetes team, or if they are unavailable, by an obstetrician.

6.2 Neonatal Care

- The mother should be made aware of the benefits of breast-feeding on metabolic control for both her and her infant .

●Feeding should be advised within 30 minutes of birth and this aspect of care must be documented.
●Skin to skin contact should be initiated at birth to prevent neonatal hypothermia and hypoglycaemia.
●Test neonatal blood glucose levels according to the following guideline:
●Once neonatal blood glucose levels are normal, glucose monitoring can be discontinued and responsive feeding encouraged.

7. Antenatal care of Women with Type 1 and Type 2 Diabetes

All pregnant women with preexisting diabetes will be cared for by the multidisciplinary team of Consultant Obstetricians, Consultant Endocrinologist, Diabetes Educator and Dietitian(table 5)

7.1 Organisation of Antenatal Care

●Be referred at pregnancy confirmation and an appointment arranged for the joint diabetes antenatal clinic within one week of referral. (NICE 2015).
●Have contact with the Joint Diabetes Antenatal Clinic for assessment of glycaemic control every 1-2 weeks this will be through face to face appointments monthly.
●Consultant Obstetrician at the dating scan appointment and then after the serial growth scan appointment at 28 weeks.
●Obstetrician, with Consultant overview, after 20-week Anatomy and Placental localisation scan, and remainder of serial growth scan appointments. They will be reviewed in between depending on the individual management plan.
●Endocrinologist at dating scan, after 20-week Anatomy and Placental localisation scan and serial growth scans. Further input at the request of the Diabetes educator or Consultant Obstetrician.figure2.

7.2 Retinal Screening Pathway

●Offer retinal screening pathway in each trimester of pregnancy.
●Eye Screening Team will refer to Ophthalmologist if there is evidence of pre- proliferative retinopathy or macular oedema detected by screening.

Table 5 : Timetable for ANC clinic appointments for women with preexisting diabetes

GESTATION	WITH WHO	ACTION
1st appointment As soon as after pregnancy confirmed	Diabetes/ Obstetrics	Ensure booking and dating scan in place Blood glucose and ketone monitoring equipment given Blood glucose target agreed and review of medication Ensure prescribed folic acid 5mg Dietary advice and review of carbohydrate counting management Offer use of CGM for pregnancy Diabetes bloods HbA1c and renal screen including 24- hour urine protein or ACR Refer for retinal screening pregnancy pathway. Discuss implication of diabetes in pregnancy and importance of good glycaemic control on pregnancy and neonatal outcomes Discuss need for close monitoring 1-2 weekly Advice on hypoglycaemia awareness Ensure has supply of glucagon Discuss sick day rules Arrange follow up by telephone if able to access virtual BG review otherwise face to face DSM to review additional support needs
Dating appointment	Dating appointment Obstetric/ Diabetes Team review Diabetes team	Routine observations Dating scan and 1st trimester screening Book anomaly and serial growth scans for 28, 32 and 36 weeks Review booking and diabetes bloods Prescribe Aspirin 150mg and Vit D supplements (included within pregnancy vitamins) from12 weeks Review of medications Review additional support needs BG review Medication and management plan
16 weeks	Diabetes team Obstetric Team review	BG review Review retinal screening or ensure has appointment Ensure has CMW appointment Or if attends antenatal clinic: Routine observations 2nd trimester Hba1c and renal screen
20 weeks	Diabetes Team review	BG review
20 weeks	Obstetric/ Diabetes team review	MDT review Review of management plan Review anomaly scan.

24 weeks	Diabetes Team	BG review and follow up arranged. Ensure 2nd trimester retinal screening booked.
27weeks	Obstetric/ Diabetes team review	Hba1c and renal screen including 24-our urine collection MDT discussion Review growth scan Ensure routine AN carried out Obstetric plan for increased surveillance if required Ensure routine bloods taken for FBC, group antibodies Anti-D offered if required Review additional support
32 weeks	Obstetric/ Diabetes team review	Review BG levels Ensure 3rd trimester retinal screening booked Management plan review and MDT discussion Ensure routine AN care Review growth scan Review additional support needs
34 weeks	Obstetric/ Diabetes team review	Review BG levels
36 weeks	Obstetric/ Diabetes team review	BG levels reviewed recommend post-delivery insulin/metformin plan Management plan review and MDT discussion Diabetes plan for delivery including VRIII and neonatal care discussed Ensure routine AN care and review additional support needs Review growth scanTiming and mode of delivery

- Diabetic retinopathy should not be considered a contraindication to rapid optimisation of blood glucose control in women who present with a high HbA1c in early pregnancy.
- Diabetic retinopathy should not be considered a contraindication to vaginal birth.

7.3 Renal Assessment during Pregnancy

For renal assessment in pregnancy perform:

- 24-hour urine collection for protein at the first contact and repeat in each trimester OR
- Urinary Albumin Creatinine ratio (ACR) at the first contact and repeat in each trimester

. If urine ACR > 20mg/mmol: also complete 24-hour total urine protein.

. If urine ACR ≤ 20mg/mmol and blood pressure is normal:continue with urine ACR (3,7).

7.3.1 Referral to a nephrologist should be considered if :

- The serum creatinine is abnormal 1.36 mg/dl
- The urinary albumin creatinine ratio is greater than 30 mg/mmol
- The total protein excretion exceeds 2 g/day, eGFR should not be used during pregnancy (2,3)
- Thromboprophylaxis should be considered for women with proteinuria above 5 g/day (Albumin: Creatinine Ratio greater then 220mg/mmol(macroalbuminuria).
- Women with diabetes and retinopathy requiring treatment during pregnancy and/or kidney impairment (CKD 2)with significant proteinuria i.e. ACR> 30; or CKD 3 or more should be managed in a regional maternal medicine center where care can be delivered in a single MDT clinic.

7.4 Preventing Pre-eclampsia and Neural Tube Defects

- Aspirin 150 mg to all women with pre-existing diabetes from 12 weeks until delivery unless any allergies / contraindications.
- Folic acid 5 mgs once daily until 12 weeks pregnant. If not already taking - commence at booking. (2,3)
- Pregnancy supplements which include Vitamin D.

7.5 Monitoring Fetal Growth and Well being

- Dating scan and anatomy scan at 20 weeks.
- Ultrasound monitoring of fetal growth, amniotic fluid volume and dopplers every 4 weeks from 28 weeks.
- An individualised approach to monitoring fetal growth and well being for women with diabetes and a risk of fetal growth restriction e.g. macro vascular disease and/or nephropathy.

7.6 Managing Diabetes in Pregnancy

- Advise women with insulin-treated diabetes of the risks of hypoglycaemia and impaired awareness of hypoglycaemia in pregnancy, particularly in the first trimester.
- Advise to have available a fast-acting form of glucose and when to use.
- Provide glucagon to pregnant women with type 1 diabetes and instruct the woman and her Husband or other family members in its use.
- Provide pregnant women with type 1 diabetes with blood ketone testing strips and a meter and urine ketone testing.
- Advise pregnant women with diabetes to seek urgent medical advice if they become hyperglycaemic, have blood ketones >1.5mmol/l or are unwell.

7.6.1 Monitoring Blood Glucose Levels

●Advise pregnant women with Type 1 and Type 2 diabetes of the target levels for good glycaemic control:
●Fasting below 95 mg/dl
●1 hour after meals: below 140 mg/dl
●2 hours after meals: below 115 mg/dl
●Bedtime below 140 mg/dl
Be aware that the target level may not be achievable if problematic hypoglycaemia occurs.

Women with Type 1 diabete
IShould be offered continuous glucose monitoring (CGM) to monitor glycaemic Control in pregnancy (14).

Women with Type 2 diabetes
●should be provided with a glucose meter.
●on multiple daily doses of insulin should be offered an alternative to blood glucose monitoring if glycaemic targets are not achieved. For example, intermittently scanned continuous glucose monitoring known as Libre.
●To document glucose readings and bring to each appointment to enable review.
●Clinical care summary and any changes required to treatment will be documented on medical notes.

7.7 CGM (Continuous Glucose Monitoring) in Pregnancy

CGM measures glucose continually in the interstitial fluid using a small sensor that is worn on the skin. Its accuracy is comparable to capillary blood glucose testing. Continuous glucose monitoring measures glucose levels in the interstitial fluid underneath the skin which is different from finger prick testing which measure glucose in blood. CGM provides a reading of glucose level and also a series of arrows. The arrows show where the glucose has been over the last 20 minutes and where it will go in the next 20-30 minutes. The number of arrows indicates the rate of change. The interstitial glucose lags behind blood glucose by about 5-10 minutes.
If the readings are different, act on the finger prick test result. Women using CGM are required to check finger prick testing in several circumstances:
•To confirm hypoglycaemia
•If symptoms do not match sensor reading
•If the sensor reading seems unlikely in the circumstances
•During and after exercise
•If the sensor does not provide a reading
•When following sick day rules or managing unexplained hyperglycaemia
●Advise pregnant women with diabetes to seek urgent medical advice if they become hyperglycaemic, have blood ketones >1.5mmol/l or are unwell.

7.6.1 Monitoring Blood Glucose Levels

●Advise pregnant women with Type 1 and Type 2 diabetes of the target levels for good glycaemic control:
●Fasting below 95 mg/dl
●1 hour after meals: below 140 mg/dl
●2 hours after meals: below 115 mg/dl
●Bedtime below 140 mg/dl
Be aware that the target level may not be achievable if problematic hypoglycaemia occurs.

Women with Type 1 diabete
IShould be offered continuous glucose monitoring (CGM) to monitor glycaemic Control in pregnancy (14).

Women with Type 2 diabetes
●should be provided with a glucose meter.
●on multiple daily doses of insulin should be offered an alternative to blood glucose monitoring if glycaemic targets are not achieved. For example, intermittently scanned continuous glucose monitoring known as Libre.
●To document glucose readings and bring to each appointment to enable review.
●Clinical care summary and any changes required to treatment will be documented on medical notes.

7.7 CGM (Continuous Glucose Monitoring) in Pregnancy

CGM measures glucose continually in the interstitial fluid using a small sensor that is worn on the skin. Its accuracy is comparable to capillary blood glucose testing. Continuous glucose monitoring measures glucose levels in the interstitial fluid underneath the skin which is different from finger prick testing which measure glucose in blood. CGM provides a reading of glucose level and also a series of arrows. The arrows show where the glucose has been over the last 20 minutes and where it will go in the next 20-30 minutes. The number of arrows indicates the rate of change. The interstitial glucose lags behind blood glucose by about 5-10 minutes.
If the readings are different, act on the finger prick test result. Women using CGM are required to check finger prick testing in several circumstances:
•To confirm hypoglycaemia
•If symptoms do not match sensor reading
•If the sensor reading seems unlikely in the circumstances
•During and after exercise
•If the sensor does not provide a reading
•When following sick day rules or managing unexplained hyperglycaemia
•As an inpatient using variable rate insulin infusion.
Offer pregnant women with type 1 diabetes blood ketone testing strips and meter and advise
to test their ketone levels if they are hyperglycaemic (blood glucose ≥ 180 mg/dl) or unwell.

The CONCEPTT trial in 2017 showed that compared to intermittent capillary glucose monitoring ,CGM, (8) resulted in :

- More women achieving their blood glucose target.
- A reduction in large for gestational age babies.
- Fewer caesarean sections.
- A reduction in neonatal hypoglycaemia.
- Fewer neonatal intensive care unit admissions.

If admitted to hospital during pregnancy:

- Women using CGM can continue to self-manage with CGM provided they are confident the sensor is working well.
- If an adverse glucose level is identified on CGM capillary blood glucose should be checked before action is taken.
- If VRIII (Variable Rate Intravenous Infusion of Insulin) is required, hourly capillary blood glucose should be undertaken. Refer to Table 4 for VRIII Guidance
- Women with pre-existing diabetes who are unable to use or be supported with these technologies should be provided with a blood glucose meter.
- To document glucose readings and bring to each appointment to enable review .

7.8 Monitoring HbA1c

- Measure HbA1c levels in all pregnant women with pre-existing diabetes at booking to determine level of risk.
- Measure HbA1c levels in the 2nd and 3rd trimesters to assess level of risk.
- Those with an HbA1c above 6.5% at the start of the third trimester should be offered increased surveillance including additional diabetes nurse/dietetic support, more frequent face to face review and input from their named, specialist Consultant to plan ongoing care and timing of birth decisions (table 6 Target HbA1C during pregnancy)

Table 6 :Target HbA1C during pregnancy

HbA1c 6.1%	Continue specialist care
HbA1c 6.2 - 6.5%	Consider additional input to improve glycemic levels
HbA1c more than 6.5%	MDT discussion. Offer alternative methods of monitoring treatment, offer increased fetal surveillance, rediscuss increased risk of stillbirth, birth and neonatal complications

7.9 Timing and Mode of Delivery

•Discuss the timing and mode of birth with pregnant women with diabetes during antenatal appointments, especially during the third trimester. (2)
•Pregnant women with diabetes who have an ultrasound-diagnosed macrosomic fetus should have the risks and benefits of vaginal birth, induction of labour and Caesarean section explained.
•Advise pregnant women with type 1 or type 2 diabetes and no other complications to have an elective birth by either induction of labour, or by elective Caesarean section if this is indicated, between 37+0 weeks and 38+6 weeks of pregnancy.
•Diabetes should not in itself be considered a contraindication to attempting vaginal birth after a previous Caesarean section.

7.9.1 Fetal Monitoring

Continuous electronic fetal monitoring in labour should be recommended to all women with diabetes.

7.9.2 Blood Glucose Control during Induction and Labour

Women will have an intrapartum and postnatal plan for management of their diabetes made in the Diabetes or Obstetric Antenatal Clinic at 36 weeks, and it should be documented on medical notes.

7.9.3. During cervical ripening or induction:

Blood glucose testing, insulin and/or oral treatments should continue as per pregnancy regime.

7.9.4 Once established in labour or labour augmented:

•Commence VRIII for women with diabetes treated with multiple daily doses of insulin.
See Table 4 : Guidance for VRIII
•Prior to VRIII commencing measure capillary blood glucose and obtain blood for FBC, Urea ,electrolytes(U&E) and haematocrit
•Monitor capillary blood glucose every hour during labour and birth and ensure that it is maintained between 90 and 144 mg/dl.
•Long acting insulin will continue during VRIII
•Short acting insulins will be stopped once the VRIII is commenced.

7.9.5 Women with Type 2 diabetes but not on multiple daily doses of insulin will not require VRIII unless:

•Capillary blood glucose reading >144 mg/dl on 2 consecutive readings and/or
• urinary ketones ++ or more on urinary dipstick and/or
• blood ketones > 1.5 mmol/L .

7.9.6 Women on insulin pumps:

▪Insulin pumps are becoming a more popular technology for people with diabetes.
▪A VRIII is recommended during labour in place of their insulin pump. This will allow staff to manage glucose levels during labour when it becomes difficult for self-management.
▪Start VRIII when labour commences or augmentation is about to start.Women who choose to continue to use their insulin pump during labour will have been advised by the diabetes team and have a plan documented on medical notes.
▪Without this pre-arranged plan VRIII will be required.
▪Transfer to VRIII if:
•The woman is unable to manage her own insulin needs
•Blood glucose > 144 mg/dl on two consecutive occasions
•Urinary ketones ++ or more on urinary dipstick
•Blood ketones > 1.5 mmol.
If transfers to VRIII, stop pump completely and restart post-natally following discontinuation of VRIII.

7.9.7 Management of Elective Caesarean section (LSCS)

•On admission, obtain bloods for U& E's and venous random blood glucose.
•Women with Type 1 diabetes will require VRIII.
•Women with Type 2 diabetes not on multiple daily doses of insulin will not require VRIII for elective surgery unless pre-surgery BG level > 144 mg/dl .

7.9.7.1 For women scheduled on a morning List

•Admit morning of caesarean section at 7am.
•Fast from midnight.
•Omit morning insulin.
•Commence VRIII no later than one hour prior to LSCS
•Check capillary blood glucose reading prior to start of VRIII..

7.9.7.2 For women scheduled on an afternoon List

•Admit 11:30am
•Usual insulin with breakfast no later than 7 am then fast.
•Commence VRIII no later than one hour prior to LSCS.
•Check capillary blood glucose reading prior to VRIII.

For women on an Insulin Pump, the Diabetes team should liaise with the anaesthetist during the preoperative assessment appointment in the Antenatal ward If suitable for insulin pump therapy peri-operatively then the plan will be documented on medical notes. Without this VRIII during LSCS will be required.

8. Postpartum recommendations for women with diabetes

NICE recommends that babies of mothers with all types of diabetes should be monitored for neonatal hypoglycaemia for at least 24 hours post-delivery.

8.1 Women with insulin-treated diabetes before pregnancy

• Insulin requirements drop immediately after delivery of the placenta. Commonly used options include reverting to the pre-pregnancy dose, 25% reduction from the first trimester dose or 50% of the late pregnancy doses. Postpartum insulin doses should be reviewed in conjunction with diabetes team daily, with an emphasis on minimising risk of maternal hypoglycaemia, and before hospital discharge.

•The rate of VRIII (if and when used) should be reduced by 50% immediately after delivery. Hourly glucose monitoring should be continued until the first meal is eaten. Ensure woman is eating and drinking before restarting subcutaneous insulin.
•VRIII should be stopped 30 - 60 minutes after the first subcutaneous pre-meal insulin injection. Women using CSIII may not necessarily require pre-meal insulin with the first light meal after delivery .

•A post-partum glucose target range of 108 - 180 mg/dl is applicable for women with insulin-treated diabetes. This applies to hospitalized patients on glucose lowering medication.

•Postpartum insulin regimen should be resumed as per individual diabetes management plan. If there is no documented diabetes plan, the early pregnancy (about 12 weeks gestation) doses should be reduced by 25% or the late pregnancy (about 36 weeks gestation) doses by at least 50%.

•Healthy eating should be encouraged with increased carbohydrate as required to minimize the risk of hypoglycaemia, if breastfeeding / expressing.
•Women should be advised to snack (10 - 15 g carbohydrate) and drink each time they feed or express milk (including night feeds). Up to 450 extra calories per day may be needed when feeding is fully established. Healthy eating should be encouraged without additional calories or carbohydrates for women who are bottle feeding.

8.2 Women previously not on insulin

•Insulin infusion or injections should be stopped when the placenta is delivered.
•In women on oral medications before pregnancy, glucose monitoring should be continued 4-hourly until the first meal. There after pre-meals and pre- Bed time glucose levels should be monitored. Because metformin does not cause hypoglycaemia, a target glucose range of 72-180 mg/dl is acceptable. For those on other oral glucose lowering medications the target range is 108 – 180 mg/dl .(2, 21)
In women with gestational diabetes (GDM), all glucose lowering medications should be stopped after the placenta is delivered. Glucose levels should be monitored pre- and post-meals for 24 hours to detect new or pre-existing diabetes (fasting glucose > 126 mg/dl and post-meal > 200 mg/dl). (2, 21).
•Healthy diet choices should be encouraged with low GI diet along with weight management advice and referral for national diabetes prevention and/or weight management programs as applicable. (2, 21)

9. Women on insulin pump

If she hasn't already done so, the woman must change the pump settings to her postnatal settings as described on her individual care plan provided by the diabetes team.
If the woman's pump has been discontinued it should be re-connected for one hour prior to discontinuing The VRIII. Only discontinue VRIII when the woman can safely manage her own pump.In the absence of a documented individual care plan, ensure the woman changes her pump following the advice below. (2, 21)
•Basal rates should be reduced to 0.5 units per hour
•Insulin to carbohydrate ratios should be changed to1unit of insulin per15g of carbohydrate.
•Insulin sensitivity should be increased to 72 mg/dl.
•Blood glucose targets should be increased to 108 – 180 mg/dl
Please note that an insulin bolus is usually not required for the first light meal taken post-delivery. The emphasis is now on avoidance of maternal hypoglycaemia so glucose targets are relaxed (table10).

10. Post-natal advice and review

Contraception/plans for future pregnancy: Safe effective contraception is required to reduce risks of unplanned pregnancy. Support planning for future pregnancy with the diabetes team and encourage continuing contraception until 5 mg folic acid is taken (must be prescribed), target glucose levels (HbA1c < 6.5%) and healthy pre-pregnancy body weight are achieved.
•Arrangements for on-going diabetes care. For women with pre-existing or new onset diabetes, follow-up plan for diabetes management should be put in place.
•Fasting plasma glucose arrangements at 6-13 weeks post-natal. For women with GDM, fasting plasma glucose should be done at 6-13 weeks after delivery to diagnose diabetes post-partum. HbA1c after 13 weeks is an alternative if the fasting plasma glucose is not done before 13 weeks post-partum .

Annual HbA1c measurement is required during further follow up in women who have a negative post-natal test.

•Lifestyle modifications. Women with gestational diabetes have a ten times increased risk of developing type 2 diabetes within 5 years.

•Breastfeeding support. Women should be counselled about the maternal and child benefits of breastfeeding and be offered support to establish breastfeeding if this is how they choose to feed their baby.

•Review of medications. Women who are breast feeding with pre-existing type 2 diabetes can take metformin after birth but should avoid other oral glucose lowering drugs. Women should continue to avoid medicines for their diabetes complications that were stopped for safety reason during pre-conception period or when pregnancy was identified.

•Women with type 1 diabetes should be screened for post-partum thyroiditis with a TSH at 3 and 6 months postpartum.

11. Neonatal Care

●On delivery of the baby the Midwife will inform the Neo-natal Unit.

●All babies refer to care of babies at risk of hypoglycemia for care plan.

●Babies of Diabetic mothers should stay with the mother unless extra neonatal care is required.

●Babies should not be discharged until they are at least 24 hours old, maintaining their blood glucose levels and feeding well.

●Babies should be fed as early as possible, within 30 minutes of birth, and then at frequent intervals 2-3 hours, until pre-feeding blood glucose levels are maintained at 94 mg/dl or more.

●Blood glucose levels should be taken within 30 minutes after birth using a quality-assured method (Haemacue) or laboratory analysis.

●Blood glucose levels should be checked if the baby has signs of hypoglycaemia.

●Follow Guidelines for Care of babies at risk of Hypoglycaemia.

● Blood tests should be taken for polycythaemia (FBC), hyperbilirubinaemia (SBR), hypocalcaemia (calcium levels) and hypomagnesaemia (magnesium levels) if the baby has any clinical signs.

11.1 Reasons for admission to the neonatal unit

●Is hypoglycaemic with abnormal signs.

●Has respiratory distress.

●Has signs of cardiac decompensation, neonatal encephalopathy or polycythaemia.

●Needs intravenous fluids.

●Needs tube feeding (unless adequate support is available on the postnatal ward).

●Is born before 36 weeks.

12. Hypoglycaemia in pregnant women with Diabetes

Hypoglycaemia is a blood glucose of 72 mg/dl or less.Wherever possible, check blood glucose level prior to treatment ,If patient asymptomatic, repeat test.

- Treatment of blood glucose level < 72 mg/dl in women with GDM
- Symptoms of hypoglycaemia include sweating, shaking, dizziness, anxiety or the woman reports feeling unwell rather than just hunger.
- If the woman is symptomatic, offer food/drink or give IV dextrose if nil by mouth.
- If on diet/metformin and the woman is asymptomatic, no action needs to be taken. If on insulin or VRIII, treat as 'hypo' and follow hypoglycaemia guidelines.(24-27), table 7

13. Steroid administration in women with Diabetes

13.1 Practical guidance for management of glucose during steroid use

- Administration of antenatal steroids for fetal lung maturity is recommended before 34+0 weeks and considered among women at risk for preterm birth between 34+0 and 35+6 weeks
- Administration of steroids may result in a deterioration of glucose levels for 2 to 3 days.This should be anticipated and actively managed.(28)recommends regular monitoring of BG levels in these women.
- Insulin (s.c.) may need to be started in women managed by diet or metformin and an increase in s.c. insulin dose typically by 50% is needed in those who are already on insulin.
- Although diabetes in pregnancy is not a contraindication to antenatal steroids, steroid administration can cause a rise in maternal blood glucose levels and precipitate ketoacidosis.
- In diabetic women steroids are recommended if vaginal delivery is likely to be before+ 38 weeks gestation. If delivery is by planned CS steroids should be administered up to 39 weeks. (2, 28)
- Dexamethasone phosphate is given intramuscularly in two divided doses of 12 mg 24hours apart or four divided doses of 6 mg 12 hours apart.
- Betamethasone sodium phosphate/acetate is given intramuscularly in two divided doses of 12 mg 24 hours apart. (2, 28)
- The course may be repeated after 7 days if the risk of preterm labour persists but not for than 3 courses .(2, 28)
- Complications: it may result in neonatal hypoglycaemia, which may have a long term effect on learning abilities in term neonates (CHYLD) Study, low birth weight, decreased head circumference and neonatal length in term neonates, psychiatric and behavioural problems in childhood, maternal hyperglycaemia. and glucose intolerance for up to 5 days after administration.

- Contraindications,Systemic infection, and the benefits should be balanced against the risk of exacerbating the severity of systemic infection for the mother and her baby.(2,28)
- Ensure individualised management plan is developed for each woman.

TABLE 7: MANAGEMENT OF HYPOGLYCEMIA DURING PREGNANCY

MILD hypoglycemia (72 mg/dl)	MODERATEhypoglycemia (36 - 54 mg/dl)	SEVERE hypoglycemia (18 mg/dl)
-Patient conscious & able to swallow	-Patient conscious and able to swallow but in need of assistance	-Patient unconscious and unable to swallow
-Trembling, sweating, hungry, tingling, headache, anxiety, palpitations, nausea, forgetfulness	Difficulty concentrating, confusion, weakness, drowsiness, headache, dizziness, difficulty focusing and speaking	-Unconscious,fitting
Step 1		
Administer 10-20 g fast Acting glucose 3-5 GlucoTabs (4g glucose per tablet) OR 1 x 60ml bottle of Glucojuice	Administer 1-2 tubes of GlucoGel (10g glucose per tube) * Ensure gag reflex is present	Check airway Place patient in recovery position, Intramuscular injection of Glucagon 1mg
Step 2		
Wait 15 minutes and recheck glucose levels, and record.If reading is still below 72mg/dl, or if no physical improvement, repeat STEP 1	Once patient is conscious, give sips of Glucose Liquid Blast or Lucozade. Recheck glucose level every 15 minutes to ensure increase to at least 72 mg/dl.	

*ALWAYS FOLLOW UP WITH A SLOWLY DIGESTED/ STARCHY CARBOHYDRATE
* Check glucose level: Once it is at 72 m/dl or over, and patient is recovered,
- eat a minimum of 15g slowly digested/starchy carbohydrate e.g 1 x slice/sandwich of low GI bread (ideally multigrain or granary);
- two digestive biscuits, glass of milk, banana, small carton of fruit juice.
- Recheck glucose levels after 15 minutes.

NOTE: Insulin should NEVER be omitted following an episode of hypoglycaemia.

13.2 How to prevent severe maternal hyperglycaemia and possible ketoacidosis

- Admit to Antenatal ward before 12.00 if possible
- Inform diabetes team of admission
- Administer first dose of steroids
- Blood glucose estimation by glucose meter pre and post prandial (breakfast, lunch and dinner) and bedtime until 24 hours after 2nd dose of steroids
- Twice daily U&E whilst on variable rate insulin infusion

13.3 For patients on diet or metformin

- An individualised plan will be in the notes. Continue Metformin if taking already.
- All patients should have blood glucose monitored pre and post prandial (breakfast, lunch and dinner) and bedtime and urinary ketones measured at each void.
- If glucose rises above 144 mg/dl blood glucose should be retested after 1 hour and if remains above 144 mg/dl start variable rate intravenous insulin and seek medical advice.
- Check blood ketones .
- For patients on subcutaneous insulin increase all insulin doses by 50% 6 hours after the first dose of steroids
- Maintain this increase until 24 hours after the second dose of steroids.
- If BG levels are greater than 144 mg/dl , retest after 1 hour and if remains above 144 mg/dl check for blood ketones and commence IV variable rate insulin. (Table 8).

13.4 For type 1 diabetes

continue long acting insulin (Lantus, Levemir, NPH) and VRIII.

13.5 . For type 2 diabetes

Stop all subcutaneous insulin and switch to variable rate insulin infusion only. If BG levels remain higher than target on two consecutive occasions then VRIII may be used. If VRIII is used in this context, the following approach is suggested.

- Check U+Es prior to starting VRIII to monitor fluid balance and electrolyte abnormalities.

Repeat 24 hourly Start variable rate intravenous insulin infusion (VRIII) (50 units human soluble insulin [Humulin® S or Actrapid®] made up to 50 mL with 0.9% NaCl) to achieve the target blood glucose of either 72 – 140 mg /dl or 90 – 144 mg/dlL . Use the scale in Tables 8 below.

- Continuous intravenous insulin may be needed until 12 hours after the administration of the second dose of steroids
- Basal insulin needs to be continued as usual. We recommend that meal time insulin is continued if the woman is eating and drinking to achieve adequate management of glycaemic excursions after meal. Appropriate documentation and education are needed to prevent insulin errors.

- When on VRIII, check capillary blood glucose level hourly aiming for blood glucose (BG) 72 – 140 mg/dl.
- We recommend 0.9% NaCl with 5% glucose and 0.15% KCl (20 mmol/L) or 0.3% KCl (40 mmol/L) as the substrate fluid with i.v. insulin to avoid maternal and neonatal hypoglycaemia, hyponatraemia and hypokalaemia. The rate of substrate infusion should take into account the volume status but generally 50 mL/h would be reasonable.

IFluids, particularly dextrose containing fluids, may have to be restricted in patients who are at risk of or already have hyponatraemia.

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

13.6 Subcutaneous insulin pump :

When first dose is administrated, the basal rate should be increased to 150%, by using the temporary basal rate. When the second injection of steroid is given, if the blood glucose level rises above 144 mg/dl, the basal rate will need to be further increased, in further 10% increments until blood glucose levels are under control (below 144mg/dl) .

- If BG levels are greater than 144 mg/dl , check for blood ketones.
- If optimal glycaemia cannot be achieved (e.g. 2 consecutive blood glucose (BG) readings > 144 mg/dl), a variable rate intravenous insulin infusion (VRIII) can be considered Table8).
- The insulin pump should be disconnected, labelled and stored securely for future use

Table 8 : VRIII for use during administration of antenatal steroids

When first dose is administrated, the basal rate should be increased to 150%, by using the temporary basal rate. When the second injection of steroid is given, if the blood glucose level rises above 144 mg/dl, the basal rate will need to be further increased, in further 10% increments until blood glucose levels are under control (below 144mg/dl) .

- If BG levels are greater than 144 mg/dl , check for blood ketones.
- If optimal glycaemia cannot be achieved (e.g. 2 consecutive blood glucose (BG) readings > 144 mg/dl), a variable rate intravenous insulin infusion (VRIII) can be considered Table8).
- The insulin pump should be disconnected, labelled and stored securely for future use

Algorithm→	1	2	3
Finger prick BG Levels mg/dl	For most women	For women not controlled on algorithm 1 or needing >80 units/ day of insulin	For women not controlled on algorithm 2 (after specialist advice)
	Infusion Rate (units/h = mL/h)		

<90	STOP INSULIN FOR 20 MINUTES if BG < 72 mg/dl Treat hypo as per guideline (re-check BG in 10 minutes)		
90-99	0.2	0.5	1.0
100-126	0.5	1.0	2.0
127-153	1.0	1.5	3.0
154-200	1.5	2.0	4.0
201-252	2.0	2.5	5.0
253-306	2.5	3.0	6.0
307-360	3.0	4.0	7.0
>361	4.0	6.0	8.0

Diabetic Ketoacidosis (DKA)

▪Diabetic ketoacidosis is a medical emergency requiring prompt treatment, and is different to a ketosis of pregnancy.Women who are suspected of having DKA are admitted to the delivery suite or the high dependency unit where they can receive medical and obstetric care.

▪Recent UK national data has suggested that the incidence rate of DKA in pregnancy is 6.3 per 100,000 (29) Risk factors were increased deprivation, mental health problems and poor long term glycaemic control. Whilst there were no maternal deaths, there was a significant (16%) fetal mortality (29).

Ketones are toxic to the fetus, and there were 11 still births and 1 neonatal death.These

ALGORITHM GUIDE

- Administer 50 units Human soluble insulin in 49.5 mL 0.9% NaCl via syringe driver). Flash or CGM glucose levels should not be used for insulin dosing during VRIII
- Start VRIII and Fluids if BG levels are > target on 2 consecutive readings and continue for up to 12 hours after the last dose
- **ALL** women with diabetes should have hourly blood glucose (BG) monitoring while on VRIII for the management of steroid hyperglycaemia during pregnancy
- **Algorithm 1**Most women will start here
- **Algorithm 2**Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1)
- **Algorithm 3**Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

*If the woman is not achieving targets with these algorithms contact diabetes team

Target BG level = 72- 126 mg/dl
Check BG every hour whilst on VRIII
Move to the higher algorithm if the BG is above target and is not dropping
Move to the lower algorithm if BG falls below 72 mg/dl or is dropping too fast

data showed that the most common precipitants were infection, vomiting, steroid treatment or medication errors (29).

- **This protocol is based on national guidance which uses a fixed rate of insulin infusion (FRIII) and a variable amount of intravenous glucose to prevent hypoglycaemia.**
- **DKA may manifest as abdominal pain – always consider as a possible alternative to pre- term/term labour.**
- **DKA can occur with only very modest elevation of glucose levels (euglycaemic DKA) in women during pregnancy.**
- **Symptoms include nausea and/or vomiting, abdominal pain, polyuria and polydipsia, and leg cramps. Later signs/symptoms include dehydration (manifesting as dry skin and mouth), blurred eyesight, tachypnoea, rapid pulse, a distinct smell on the breath (sometimes described as 'pear drops') and coma. Ketoacidosis should always be considered when a pregnant woman with diabetes feels unwell. These women must be assessed by a medical or diabetes team.**
- **Due to the potential for poor maternal and obstetric outcomes, and because these women may present to areas outside of the obstetric unit, it is incumbent on management, medical and obstetric teams to ensure that the guidelines on the management of DKA in pregnant women is included in all guidelines used outside of the maternity setting.**
- **Furthermore, institutions should consider skills and drills training on the management of DKA in pregnancy to ensure that obstetricians and midwives are aware of the symptoms and signs of diabetic ketoacidosis.**
- **DKA should always be considered when a pregnant woman with diabetes feels unwell.**

14.1 Blood ketones testing in Pregnancy

Pregnancy is a ketogenic state. Women with diabetes are at higher risk of developing diabetic ketoacidosis (DKA) when they are pregnant. Prompt detection of ketones is key to early treatment. Staff caring for pregnant women with pre-existing diabetes need education in use of blood ketone testing equipment.Blood ketone testing is more reliable compared to urine testing for ketones.Betahydroxyburate ,the main component of ketone bodies in DKA, is present in blood only (table 9)

14.2 Indications for blood ketone testing

- In well women, capillary blood ketone testing is usually ONLY indicated in women with known diabetes, unless requested by the diabetes team or senior obstetric/anaesthetic team
- Testing for ketones is indicated to differentiate between DKA and hyperglycaemia without ketosis
- If clinically unwell with sepsis and worsening of modified obstetric early warning scoring systems{ MOEWS)
- If there is sustained hyperglycaemia > 200 mg/dl on two occasions within four hours.
- If the patient has symptoms of DKA.

14.3 Diagnosis of DKA:

1.Presence of Diabetes mellitus (of any kind, DKA can occur in pregnancy in a woman with known diabetes with a normal blood glucose level) and :

2.Ketosis: urinary ketones >++ or blood ketones >3.0 mmol/L (high risk 1.5 mmol/L)

3.AND Acidosis: blood gas pH <7.3 and/or bicarbonate <15 mmol/L (N.B. bicarbonate is reduced in pregnancy). Use venous blood gases. Encourage women to contact the obstetric team if not well or vomiting – may need hospital admission for intravenous insulin regime.

Always ask when they last ate and when they had their last insulin: if they have omitted their insulin advise admission immediately.Some women are testing blood ketones on a home meter. The normal range in pregnancy is not established, but outside pregnancy <1.0 mmol/L is normal.

Table 9: Ketone monitoring during pregnancy

> 3.0 mmol/l	Dangerous level of ketones , which will require immediate care.	
1.5 -3.0 mmol/l	high ketones could present arisk of ketoacidosis it is advisable to contact health care team for advice.	
0.6 -1.5 mmol/l	Indicates more ketones are being produced than normal. Test again later to see if the value has lowered	
< 0.6 mmol/l	Normal blood ketone value	

14.4 Immediate Management of DKA

The consensus follows The Joint British Diabetes Societies JBDS guidelines for management of DKA (30) .

- DKA is a medical emergency requiring prompt treatment.
- Pregnant women with DKA need prompt review by the medical or diabetes team alongside obstetricians and anaesthetists
- Key management will be fluid resuscitation and correction of hyperglycaemia, ketonaemia and acidosis.
- Follow DKA protocol management.
- If not acidotic and therefore not in DKA, but unwell and blood ketones >1.5mmol/l or rising, start on VRIII
- For urgent inpatient diabetes advice/review by an endocrinologist

14.4.1 Treatment of DKA:

If the woman is using an insulin pump discontinue the insulin pump and start intravenous insulin infusion at a fixed rate.Use the Hospital guideline for management of DKA Some of the salient specific points in DKA in pregnancy are:

- Involve the medical or diabetes team urgently
- DKA in pregnancy should be managed in critical care
- DKA during the delivery should be managed in accordance with principles laid out in the multidisciplinary document “Care of the critically ill woman in childbirth enhanced maternal care.
- Start i.v. fluids immediately whilst awaiting the diabetes/ medical team

14.4.2 Start i.v. insulin infusion and monitor blood glucose

- Set up an insulin infusion of 50 units of soluble insulin (Humulin® S or Actrapid®) in 49.5 mL 0.9 % NaCl via syringe driver and deliver insulin at a fixed rate of 0.1 unit/kg of actual body weight/hour
- A maximum dose limit of 14 units/h should be adhered to unless specifically over- ridden by medical consultant
- The fixed rate may have to be increased by 1 unit/h if there is inadequate response (less than 54 mg/dl drop in capillary glucose per hour or less than 0.5 mmol/L drop in blood ketone or less than 3 mmol/L rise in venous bicarbonate per hour). Check the pumps and the lines and involve the medical team
- Measure capillary glucose hourly
- Glucose level is not an accurate indicator of resolution of acidosis in euglycaemic ketoacidosis, so the acidosis resolution should be verified by venous gas analysis

• Continue with the basal insulin i.e. Glargine, Detemir or Degludec but discontinue short acting insulin ** If ketones and glucose are not falling as expected always check the insulin infusion pump is working and connected and that the correct insulin residual volume is present (to check for pump malfunction).

14.4.3 Administer fluids and potassium

• The fluid requirement may be lower in pregnancy. Start with 1L 0.9% NaCl over 60 minutes and continue with the hydration fluids as per clinical need. Often patients with severe dehydration and typical DKA would need 1 litre of normal saline each in subsequent 2 hour, 2 hour, 4 hour, 4 hour, and 6 hours after the first bag. (31)

• Add 10% dextrose to run alongside 0.9% NaCl when capillary glucose < 250 mg/dl. Initially this should be administered at a rate of 50 mL/h but rate of infusion may need to be adjusted to prevent hypoglycaemia and avoid fluid overload or hyponatraemia. Currently there are not enough data to guide the speed of fluid replacement and individual discretion will be required. (31)

• Potassium may not be needed in the first bag. Aim for keeping K+ between 4.0 and 5.5 mmol/L. Add 40 mmol of KCL/L of normal saline from the 2nd litre of fluids onward. Use the pre-prepared 0.3% KCl with 0.9% NaCl

• Insulin may be infused in the same line as the intravenous replacement fluid provided that a Y connector with a one way, anti-siphon valve is used and a large- bore cannula has been placed.

14.4.4 Monitor glucose, potassium, pH and fetus

• Monitor blood glucose (BG) and capillary ketones (if available) hourly, venous bicarbonate and potassium at 1 hour, 2 hours, 4 hours and then depending upon the need, serum electrolytes 4 hourly

• Monitor fluid status as needed

• The fetus should be continually monitored but abnormalities of the fetal heart may improve with improvement of the maternal condition

13. Management of pre-eclampsia (PE) throughout in women with diabetes

Pre-eclampsia remains one of the leading causes of deaths in the puerperal period .

▪ The three pillars of treatment remain timely delivery of the fetus, blood pressure control (often with multiple intravenous infusions), and fluid restriction to 80 mL/h (including all drugs and intravenous fluids) . (31)

▪ The incidence of pre-eclampsia in women with type 1 diabetes is 10-15%.

▪As it is recognised that simultaneously managing glycaemic control using the VRIII to maintain the CBG 90 – 144 mg/dl, managing blood pressure control using intravenous magnesium and other intravenous agents delivered by multiple pumps, limiting total fluid input (including all infusions) to 80 mL/h and monitoring the fetus, the birth and the mother is complex; it is recommended that there is multi-disciplinary input into the management of these women using the principles laid out in the enhanced maternal care document. (31)

16. Management of women who present with simultaneous DKA and pre-eclampsia (21,22)

These are highly complex and vulnerable patients and need to be managed utilising principles laid out in the enhanced maternal care document.(30)

The goals of treatment include:

1.Initial fluid resuscitation
2.Administration of FRIII to stop the ketogenesis
3.Administration of potassium
4.Prevention of hypoglycaemia from use of the FRIII
5.Control of BP
6.Prevention of fluid overload
7.Timely delivery
8.Monitoring to avoid the complications of PE

17. Treatment of diabetic gastroparesis

It requires a careful balance to manage both maternal symptoms and ensure fetal safety. This involves dietary modifications, medications, glycemic control, and supportive therapies tailored to pregnancy.

17.1 Dietary Modifications

- Small, Frequent Meals: Reduces gastric burden and improves digestion.
- Low-Fat, Low-Fiber Diet: Easier to digest and reduces symptoms.
- Soft or Liquid Foods: Options like soups, smoothies, and purees are often better tolerated.
- Avoid Trigger Foods: Spicy, acidic, or carbonated foods can exacerbate symptoms.
- Consider Nutritional Supplements: To address any deficiencies.

17.2 Optimal Glycemic Control

- Tight Blood glucose Monitoring: Uncontrolled diabetes can exacerbate gastroparesis symptoms and impact pregnancy outcomes.
- Insulin Adjustments: Work with a diabetes team to adjust insulin regimens based on erratic absorption due to gastroparesis.
- Continuous Glucose Monitoring (CGM): Helps track glucose trends effectively during pregnancy.

17.3 Medications

Medication use in pregnancy must balance effectiveness with fetal safety:

- Prokinetics:

o Erythromycin (low dose): Often used as a first-line prokinetic. It stimulates gastric emptying but should be used with caution due to the potential for tachyphylaxis and limited data on long-term fetal effects.

- Antiemetics:

o Ondansetron: May be used for severe nausea, although it should be weighed against potential risks in the first trimester.

o Vitamin B6 and Doxylamine: Safe options for mild nausea and vomiting.

- Avoid:

oMetoclopramide: While it can be effective, long-term use carries a risk of extrapyramidal side effects. Its use is considered on a case-by-case basis during pregnancy.

17.4 Hydration and Electrolyte Balance

- Adequate hydration is crucial, especially if vomiting is severe.
- IV Fluids: May be needed in cases of severe dehydration or malnutrition.

17.5 Nutritional Support

If dietary measures fail:

- Enteral Nutrition: Nasogastric or jejunal feeding may be considered.
- Parenteral Nutrition: Reserved for severe cases where enteral feeding is not possible.

17.6 Management of Refractory Cases

- Collaboration with a gastroenterologist and maternal-fetal medicine specialist is essential.

17.7 Multidisciplinary Approach

Managing diabetic gastroparesis during pregnancy requires a team approach:

- Obstetrician: To monitor fetal well-being and pregnancy progress.
- Endocrinologist: For diabetes management.
- Gastroenterologist: For specialised gastroparesis care.
- Dietitian: For tailored dietary advice.

The primary goal is to control symptoms while ensuring optimal maternal and fetal outcomes , avoid medications with known teratogenic risks, especially in the first trimester, and monitor for Complications such as malnutrition, dehydration, and poor glycemic control.

Table 10 : Options for the peripartum management of women with type 1 diabetes using insulin pumps before and during birth

Continuation of CSII during labour/birth	• Empowers diabetes self- management • Reduced resource burden on delivery unit staff • Safe and effective intrapartum glycaemia, with observational data suggesting superior efficacy compared to VRIII	Manufacturers liability concerns of pump failure near diathermy sites
Planned use of VRIII during labour/birth	Complies with CSII manufacturers' guidance	Intrusive for women and resource intensive for delivery unit staff Intrinsic complications including user errors with establishment and cessation leading to DKA, fluid and electrolyte imbalance and inadvertent hypoglycaemia
CSII to be used if vaginal delivery, and VRIII if operative delivery	Complies with CSII manufacturers' guidance	As a category 1 caesarean section can be called at any time, there is a risk that the VRIII will not be established
Continuation of CSII if vaginal, and cessation of CSII if urgent section called	Complies with CSII manufacturers' guidance	CSII can be safely stopped for up to 60 minutes but must be restarted immediately post-operatively to prevent DKA

FIGURE 2 : Management of preexisting type1DM flowchart

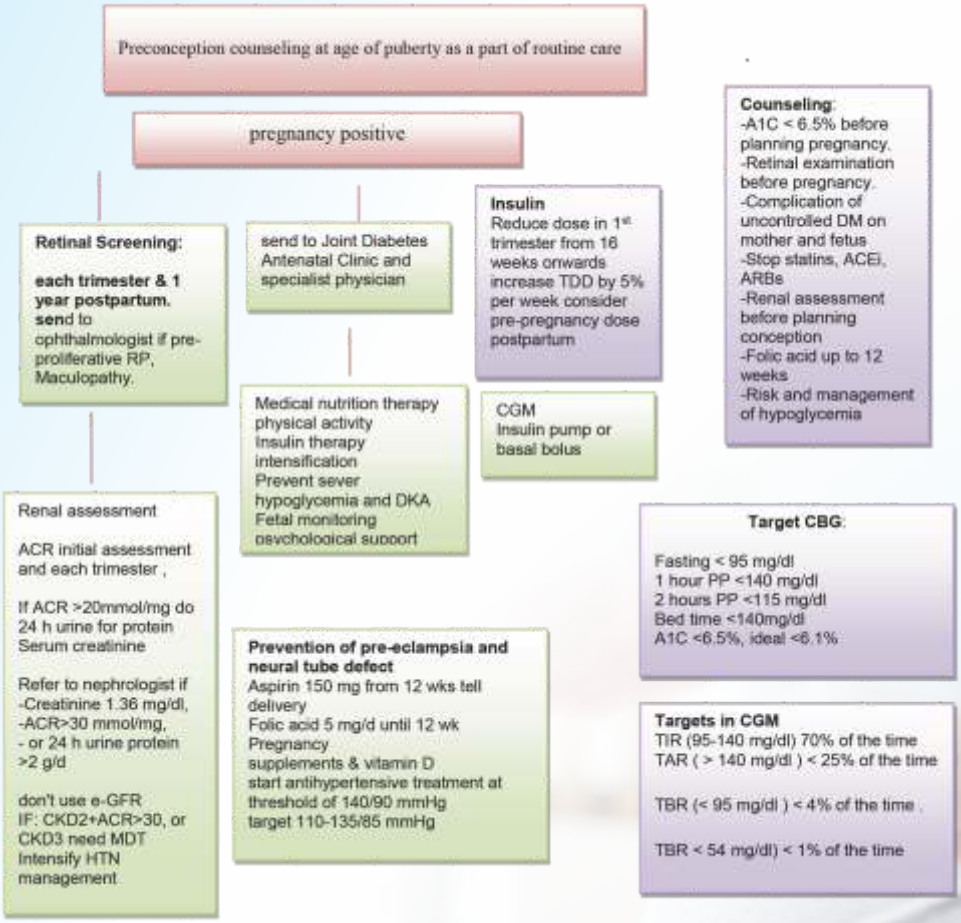


FIGURE 3 : GDM screening diagnosis and management flowchart

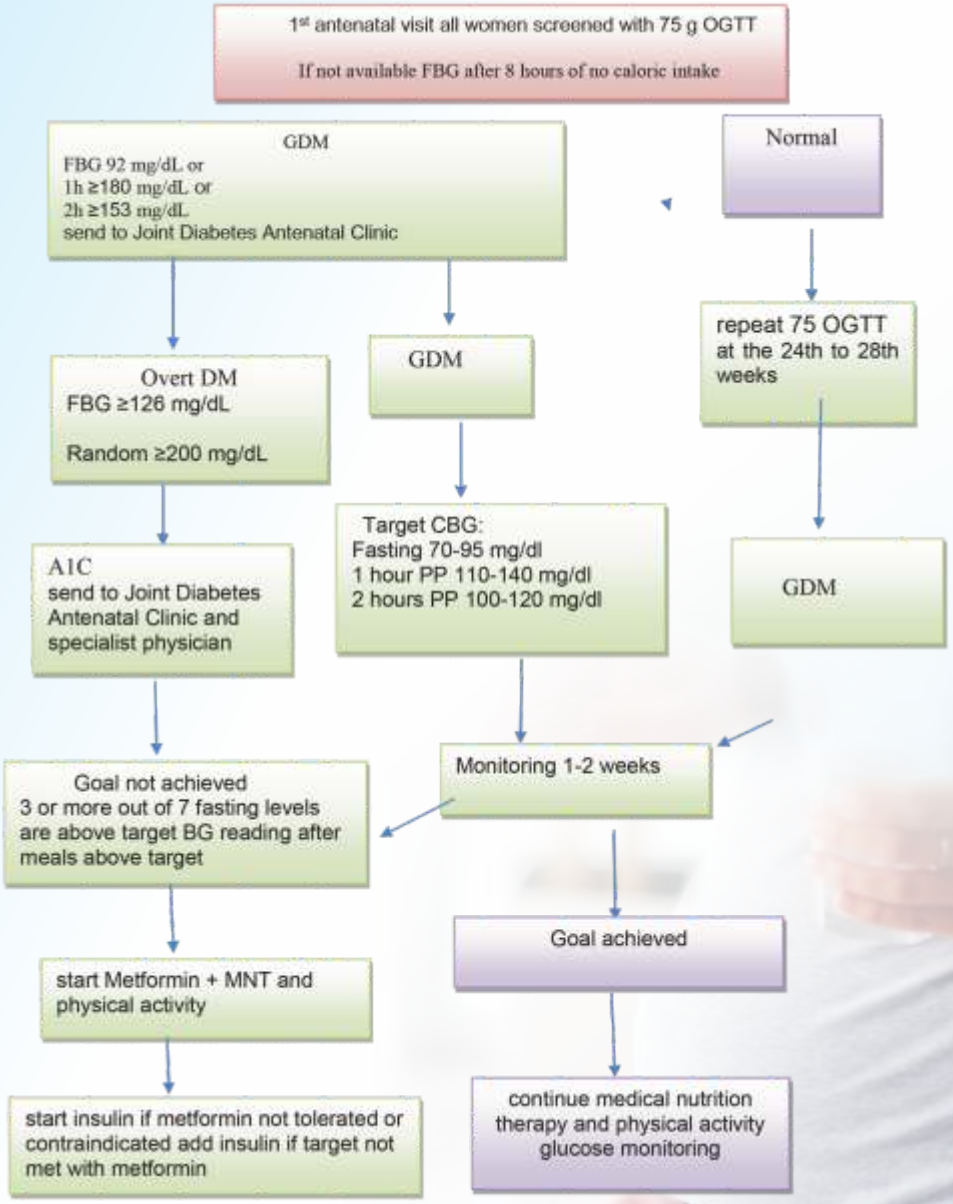
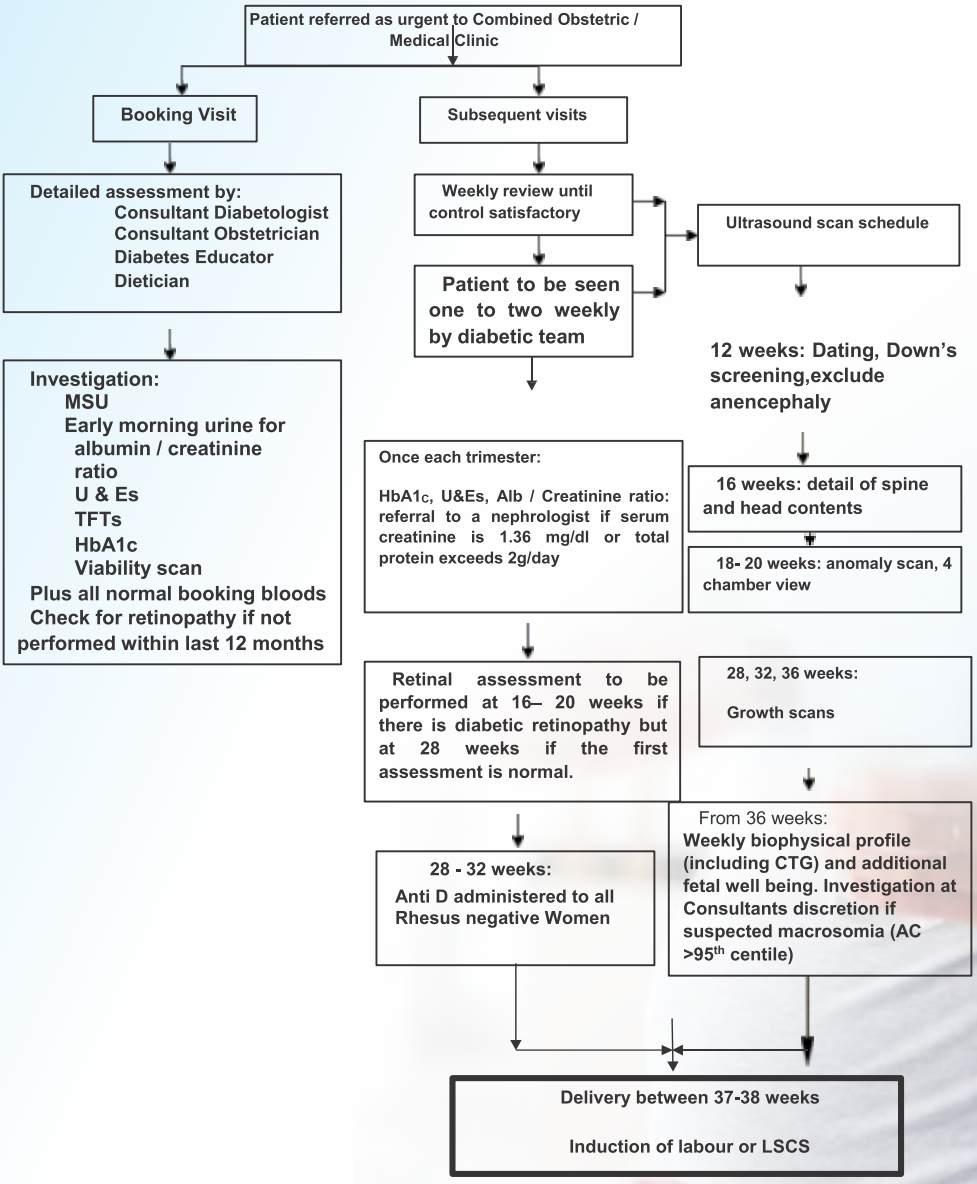


FIGURE 4 : Antenatal Management of Pre-existing Diabetes (type 1 and type 2) in Pregnancy



Glossary of terms:

ACR: Urinary albumin creatinine ratio.
BMI : Body Mass Index.
BG: Blood Glucose.
CBG: Capillary plasma glucose finger test measurement of blood glucose level.
CGM : Continuous Glucose Monitor Sensor technology that measures glucose levels via interstitial fluid to allow monitor of glucose levels 24 hours a day.
DKA : Diabetic Ketoacidosis.
DSN: Diabetes Specialist Nurse.
GDM : Gestational Diabetes Mellitus.
HIP : Hyperglycemia in pregnancy.
HbA1c Glycosylated haemoglobin .
NICE : National Institute Clinical Excellence.
OGTT : Oral Glucose tolerance test.
RCOG: Royal college of obstetricians and gynaecologist.
VRIII : Variable Rate Intravenous Insulin Infusion: Protocol to achieve normal glycaemia for patients with diabetes.
FRIII : Fixed Rate Intravenous Insulin Infusion.
MOEWS : modified obstetric early warning score .

1. IDF-MENA Region Guidelines for Management of hyperglycemia in pregnancy

2. National Institute for Health and Care Excellence. Diabetes in pregnancy: management of diabetes and its complications from pre-conception to the postnatal period , 2015.

3. American diabetes association professional practice committee. 15. Management of Diabetes in pregnancy; standards of care in Diabetes -2025. Diabetes care 2025 Jan 1:48(Supplement-1): S306-S320.8

4. NICE (2015) Diabetes in Pregnancy: management of diabetes and its complications from preconception to the post-natal period. Guideline NG3. NICE, London.7

5. International Association of Diabetes and Pregnancy Study Groups Consensus Panel. International Association of Diabetes and Pregnancy Study Groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. Diabetes Care 2010;33:676-82.9

6. Ekouevi D, Inwoley A, Tonwe-Gold B et al. Criteria for HAART should be revisited in HIV-infected pregnant women in resource limited settings. 13th Conference on Retroviruses and Opportunistic Infections, 5-8 February 2006 10

7. Scott EM, Feig DS, Murphy HR, et al. Continous glucose monitoring in pregnancy: importance of analyzing temporal profiles to understand clinical outcomes. Diabetologia. 2020;63(12):2583-2592.

8. Continuous glucose monitoring in pregnant women with type 1 diabetes (CONCEPTT): a multicentre international randomised controlled trial. Lancet 2017 Nov 25;390(10110):23472359.

9. Langer O, Yogev Y, Most O, Xenakis EMJ. Gestational diabetes: the consequences of not treating. Am J Obstet Gynecol.2005;192(4):989-997.

10. American Diabetes Association (ADA). Management of diabetes in pregnancy: Standards of Medical Care in Diabetes—2024. Diabetes Care. 2024;47(Suppl 1):S282-S294. https://doi.org/10.2337/dc24-S014

11. Hartling L, Dryden DM, Guthrie A, et al. Benefits and harms of treating gestational diabetes mellitus: a systematic review and meta-analysis. JAMA. 2013;310(1):91-92. https://doi.org/10.1001/jama.2013.6544JBDS-IP guidelines: Management of glycaemic in pregnant women with diabetes on the Obstetric wards and delivery units; May 2017

12. NICE (2022) Diabetes Type 2: What are the Risk Factors? Clinical knowledge summaries NHS England (2023) Saving Babies Lives Care Bundle (SBLCB) version 3, element 6 RCOG (2010) Late Intrauterine Fetal Death and Stillbirth.

13. Dashora U, Ahmed S, Bossman I, Aung KK, Castro E, Sathiskumar P. A service evaluation of the impact of adoption of JBDS guidelines for the management of glucose during labour and birth in women with diabetes. British Journal of Diabetes 2021;21:67-75

14. Reader D, Splett P, Gunderson EP; Diabetes Care and Education Dietetic Practice Group. Impact of gestational diabetes mellitus nutrition practice guidelines implemented by registered dietitians on pregnancy outcomes. J Am Diet Assoc. 2006;106(9):1426-1433. https://doi.org/10.1016/j.jada.2006.06.009

15. Moreno-Castilla C, Hernandez M, Bergua M, et al. Low-carbohydrate diet for the treatment of gestational diabetes mellitus: a randomized controlled trial. Diabetes Care. 2013;36(8):2233-2238. https://doi.org/10.2337/dc12-2714

16. Yamamoto JM, Kellett JE, Balsells M, et al. Gestational diabetes mellitus and diet: a systematic review and meta-analysis of randomized controlled trials examining the impact of modified dietary interventions on maternal glucose control and neonatal birth weight. Diabetes Care. 2018;41(7):1346-1361. https://doi.org/10.2337/dc18-0102

17. Han S, Crowther CA, Middleton P, Heatley E. Different types of dietary advice for women with gestational diabetes mellitus. Cochrane Database Syst Rev. 2013;(3):CD009275. https://doi.org/10.1002/14651858.CD009275.pub2

18. Mottola MF, Artal R. The role of exercise in reducing the risks of gestational diabetes mellitus in obese women. Best Pract Res Clin Obstet Gynaecol. 2015;29(1):123-132. https://doi.org/10.1016/j.bpobgyn.2014.05.022

19. Rowan JA, Hague WM, Gao W, et al. Metformin versus insulin for gestational diabetes. N Engl J Med. 2008;358(19):2003-2015. https://doi.org/10.1056/NEJMoa0707193

20. Balsells M, García-Patterson A, Solà I, et al. Glibenclamide, metformin, and insulin for gestational diabetes: a systematic review and meta-analysis. BMJ. 2015;350:h102. https://doi.org/10.1136/bmj.h102

21. Joint British Diabetes Societies for Inpatient Care (JBDS. Management of glycemic control in pregnant women with diabetes on obstetric wards and delivery units. March 2023https://abcd.care/sites/abcd.care/files/site_uploads/JBDS_IP_Diabetes_Preganancy_20-23 pdf.

22. Dashora U, Rafique S, Tharayil G, Jones S, Castro E, Sathiskumar P. The feasibility and impact of implementing NICE guidance on diabetes control during delivery. British Journal of Diabetes 2017;17:100-106

23. Modi A, Levy N, Hall GM. Controversies in the peripartum management of diabetes. Anaesthesia 2016;71:750-755

24. Levy N, Hall GM. National guidance contributes to the high incidence of inpatient hypoglycaemia. Diabetic Medicine 2019;36:120-121

25. Dashora U, George S, Sampson M, Walden E. National guidelines have contributed to safer care for inpatients with diabetes. Diabetic Medicine 2019;36:124-126

26. Yamamoto JM, Murphy HR. Inpatient hypoglycaemia; should we should we focus on the guidelines, the targets or our tools? Diabetic Medicine 2019;36:122-123.

27. Joint British Diabetes Societies for Inpatient Care. The hospital management of hypoglycaemia in adults with diabetes mellitus. April 2021 [, 2021.

28. Dashora U, Murphy HR, Temple RC, Stanley KP, Castro E, George S, Dhatariya K, Haq M, Sampson M. Managing hyperglycaemia during antenatal steroid administration, labour and birth in pregnant women with diabetes. Diabetic Medicine 2018;35:1005-1010

29. Diguisto C, Strachan MW, Churchill D, Ayman G, Knight M. A study of diabetic ketoacidosis in the pregnant population in the United Kingdom: Investigating the incidence, aetiology, management and outcomes. Diabetic Medicine 2022;n/a:e14743

30. Joint British Diabetes Societies for Inpatient Care. Joint British Diabetes Society guideline on the management of diabetic ketoacidosis in adults, 2021.

31. National Institute for Health and Care Excellence.Hypertension in pregnancy: diagnosis and management. NICE guideline [NG133] , 2019.

Acknowledgments:

The President of the Libyan Diabetes Association and the chair of the scientific committee aknowledge all the authors who contribute in the formulation and edition of this practical guide lines .in turn authors thanks the libyan diabetes association for undertaking the responsibility of writing these important practical guide lines and providing all means for their preparation, distribution and and publication .

Author contribution: NMR adapted the idea and assigned the group of authors with the chairperson KA for the scientific committee. KA leading performance of the original draft with the active participation from all authors. NMR & NA & AA reviewed the manuscript data ,NMR drafted the final manuscript ,all the authors approved the final manuscript and agreed to be accountable for its contents .

Declaration of interest:

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported .

Ethical Issues: The authors completely observed ethical issues including plagiarism,data fabrication or falsification, and double publication or submission.

Data Availability Statement: The raw data that support the findings of this article are available from the corresponding author upon reasonable request.

Author Declarations: The authors confirm that they have followed all relevant ethical guidelines and obtained any necessary IRB and/or ethics committee approvals.

Author Declarations: The authors confirm that they have followed all relevant ethical guidelines and obtained any necessary IRB and/or ethics committee approvals.

LIBYAN DIABETES ASSOCIATION

We Care

LDA

الجمعية الليبية للسكري

LIBYAN DIABETES ASSOCIATION

We Care

LDA