# MWL Adult Diabetes Guidelines 2023-2028 v1.2

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| **Title** | Adult Diabetes Guidelines 2023-2028 |
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| **Purpose** | Diabetes management guidance for non-specialists |
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| **Contact** | Email kevin.hardy@sthk.nhs.uk or call 01744646497 |
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| **Approval by**: | St Helens & Knowsley Hospitals Clinical Effectiveness Council. |
| **Target population** | Staff & students involved in the management of adults with diabetes in and around St Helens & Knowsley (this may later include West Lancs (Southport & Ormskirk) after consultation). |
| **Training needs** | All of those using the document are offered specific (specialist) training relating to use of the document – please contact Prof Hardy's secretary on 01744-646497 |
| **Superseded Guidelines** | St Helens & Knowsley Teaching Hospitals adult inpatient & outpatient guidelines all versions up to and including V36. |
| **Note** | The format of this document was approved by exception by Clinical Effectiveness Council because it is harmonised with Community and Northwest Coast versions of these guidelines in the same format. |

# Introduction

Our aim is to provide brief guidance for non-experts.

Tension exists between ease of reference and discussion of the evidence base. Consider these recommendations in conjunction with best practice guidance notably joint American Diabetes Association (ADA)/European Association for Study of Diabetes (EASD) and NICE Type 2 Diabetes Guideline, February 2022.

Other 'guidelines' produced by Diabetes UK, ABCD and JBDS arguably lean more heavily on expert opinion (Cochrane Level D) and have therefore received less weight.

As far as is practicable, diabetes care should be personalised and underpinned by NICE-compliant structured education and appropriate lifestyle advice.

Pragmatically, some management of Type 1 & Type 2 is harmonised, but where appropriate T1DM and T2DM are considered separately.

This document is for guidance only. Clinicians should always use their knowledge, experience and expertise to best manage patients' individual needs & preferences.

Use the web-version – printed or downloaded versions may be outdated & unsafe.

Drugs should be prescribed and monitored per data sheet recommendations and best practice, unless experience and the patient's best interests dictate otherwise. Insulin must always be administered using an insulin specific syringe or device. Insulin should NEVER be prescribed using 'u' or 'iu' instead of units.

If you are not confident that you have the relevant knowledge, skills and experience to manage care to an appropriate standard, consider specialist referral. Education and training opportunities are available locally and elsewhere.

You must be familiar with the drugs contained within this guideline to use them. NICE underscores the importance of assessing and discussing with patients the metabolic effectiveness, safety, individual suitability, licensing requirements & cost effectiveness of treatment options. Doctors must also be conscious of GMC prescribing guidance when prescribing treatments for people with diabetes.

Management of adults with diabetes undergoing surgery and elective procedures is subject of separate national guidance see for example:

Diabetes, surgery and medical illness | Treatment summaries | BNF | NICE

Fluid therapy for adult surgical patients is described in British Consensus Guidelines (GIFTASUP). mM = mmol/l.

## List of Topics

# Topic 1: Diagnosis of Diabetes

**Type 1 Diabetes**

Diagnosed clinically. Patient typically has thirst, dry mouth & polyuria and one or more: rapid weight loss (e.g. 1-2st in 4-8 wk), ketonaemia, BMI < 25, onset age < 50 yr (median age is 12 years in UK). Do not discount just because age > 50 or BMI > 25.

ACTION - refer to a specialist urgently (same day) - for MWL-St Helens, use our referral form – it includes the number to ring.

**Type 2 Diabetes**

(mM = mmol/litre)

| | |
|---|---|
| NORMAL = Fasting plasma glucose (laboratory) (FPG) | < 6.0 mM or |
| NORMAL = Random plasma glucose (laboratory) (RPG) | < 7.8 mM or |
| NORMAL = 120-minute OGTT glucose (laboratory) | < 7.8 mM |
| NORMAL = HbA1c (A1c) | < 42 mmol/mol |

**DIABETES – glycaemic criteria**

| | |
|---|---|
| *DIABETES = HbA1c(A1c) | ≥ 48mmol/mol (x 2) or |
| DIABETES = RPG | ≥ 11.1 mM (x 2) or |
| DIABETES = FPG | ≥ 7.0 mM (x 2) or |
| DIABETES = RPG | ≥ 11.1 mM and FPG ≥ 7.0 |

*Preferred. Don't mix test-types. Use BG tests in situations where HbA1c unreliable.

**What is left?**

IMPAIRED GLUCOSE REGULATION ('IGR' or 'Non-diabetic hyperglycaemia 'NDH')

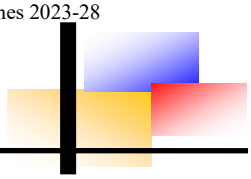
= FPG 6.0–6.9 mM (incl.) or 2 hr OGTT BG 7.8–11.0 mM (with a FPG < 7.0) or

HbA1c 42-47mmol/mol.

**Important Notes**

- Blood glucose strips / meters are **not** adequate for the diagnosis of diabetes.
- HbA1c may be unreliable in certain circumstances e.g. haemolysis.
- Second HbA1c test can be done immediately (even on same sample - Lab prefers a second sample & request), you do not need to delay – it's looking for assay variance NOT patient factors. If one HbA1c is ≥ 48 and the other is <48, then they do NOT have diabetes. There is no maximum interval between repeat tests.
- Diagnosis of GESTATIONAL diabetes is different – see **Topic 11**.

# Topic 2: Impaired Glucose Regulation (IGR) & Diabetes Prevention



**Definition**

See Topic 1

Impaired fasting glucose (IFG) = FPG 6.0 – 6.9 mM (inclusive) and Impaired glucose tolerance (IGT) = RPG 7.8 – 11.0 mM (inclusive) (with FPG < 7.0 mM.) or HbA1c 42-47mmol/mol are known as **IMPAIRED GLUCOSE REGULATION** (IGR) or **'Pre-Diabetes'**.

**Aims of Management**

1. Prevent diabetes & (preferably) restore normal glucose tolerance.
2. Reduce increased cardiovascular risk associated with IGR.
3. Detect future diabetes (should it occur) early.

**Management of IGR (IFG & IGT)**

- Local Diabetes Prevention Programmes are available – consider referral to the most appropriate local programme.

- Regular exercise prevents or delays diabetes-onset in high-risk patients. Aim for 20-30 or more minutes of daily exercise sufficient to cause breathlessness & sweating (Ideally 150 min per week - can be taken in 10 min blocks). A mix of aerobic and resistive exercise may be optimal for health.

- Modest weight loss prevents or delays the onset of diabetes in high-risk patients. Aim for sustained 5-15% weight loss. Consider enrolment in trials of low-calorie diet programmes if available.

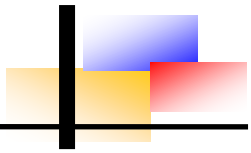
- Metformin prevents or delays the onset of diabetes in high-risk patients, but it may not as effective as lifestyle measures and has been deemed not cost-effective by some authorities.

- Cardiovascular risk factor modification is important. Consider: smoking cessation, measures to achieve BP control & Atorvastatin therapy if known vascular disease or if 10-yr CVD risk > 10% (using QRISK3).

- Consider screening in high-risk patients: BMI > 30 (or waist circumference > target), strong family history of diabetes, high risk ethnic groups, those who have delivered a baby of > 9 lb (4.1kg), hypertensive patients, PCOS patients, those with atherosclerotic cardiovascular disease (ASCVD), and if signs of insulin resistance (e.g. acanthosis nigricans) are present.

- The National Screening Committee (NSC) recommends targeted screening for diabetes in the UK.

# Topic 3: Monitoring Blood Glucose & Ketones



## Self-Monitored Blood Glucose (SMBG) & CGM

- NICE recommends frequent SMBG in Type 1 & routine SMBG in Type 2 only if patient is on insulin, has symptomatic hypo, takes medication that may increase hypo-risk (e.g. on driving) or with some drugs e.g. steroids…etc.

- Continuous glucose monitoring CGM (e.g. Freestyle Libre2 or Dexcom) is used in Type 1 (& some Type 2) patients (NICE/Mersey APC (2022)). Type 2 must be on multiple daily insulin injections and have recurrent or severe hypo or impaired hypo awareness, or have a condition/disability preventing SMBG, or need to do SMBG >8 x/day or need health professional SMBG. Libre2 is real-time from July 2023.

- Target SMBG levels are related to personalised target HbA1c:

| HbA1c goal | Pre-b'fast | Pre-lunch | Pre-tea | Pre-bed |
|---|---|---|---|---|
| **48** | 6 – 7 | 6 - 7 | 6 -7 | 7 - 8 |
| **53** | 7 – 8 | 7 – 8 | 7 – 8 | 8 – 9 |
| **58** | 8 – 9 | 8 – 9 | 8 – 9 | 9 – 10 |
| **64** | 9 – 10 | 8 – 9 | 8 – 9 | 9 – 10 |
| **69** | 9 – 10 | 9 – 10 | 9 – 10 | 10 – 13 |

## Self-Monitored Blood Ketones

- Type 1 should have and be able to use & action blood ketone test strips and should check blood ketones if SMBG >15mM **and** they feel unwell.

- Type 2 on SGLT2 inhibitor treatment should be supplied with and trained in use of urine ketone test strips to be used if they feel unwell, when ketonuria ≥ ++ should prompt seeking urgent medical advice.

## Glycated Haemoglobin (HbA1c)

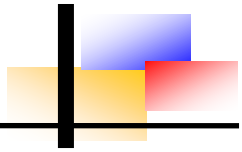
- HbA1c remains the gold standard for glucose balance over 2-3 months. Perform 3-6 monthly. HbA1c underestimates glycaemia in reduced red cell survival e.g. pregnancy or haemolysis (see (NICE 2022).

- Use personalised HbA1c targets agreed with patients as per NICE. 'Target' = threshold above which treatment intensification considered:

| | |
|---|---|
| T1 Diabetes | HbA1c < 53 mmol/mol |
| T2 Diabetes (single OHA & no hypo risk) | HbA1c < 48 mmol/mol |
| T2 Diabetes (max dose single OHA or more) | HbA1c < 53 mmol/mol |
| T2 Diabetes (special considerations) | HbA1c ≤64-69 mmol/mol |

(N.B. we underscore the need to relax targets in frail or elderly)

# Topic 4: Diabetes Annual Review



**What to do**

The following should typically be undertaken annually in primary care:

- General Diabetes review & formal assessment of need for (further) structured education (DHSC). Appropriate vaccination e.g. pneumococcal, Flu, COVID vaccines etc for those for whom it is appropriate.

- Surveillance for complications:
    - Accredited community digital retinopathy screening
    - Accredited community foot screening
    - Blood pressure assessment (see Topic 6 for targets)
    - Cardiovascular risk assessment

- Blood & urine tests:
    - HbA1c (see Topic 3)
    - Serum eGFR
    - Non-fasting lipids (see Topic 7)
    - Urine for Albumin:creatinine ratio (ACR) (Topic 12)
    - Tests related to therapy (e.g. LFTs)
    - Annual TSH measurement in T1DM
    - Occasional B12 estimation if on Metformin

**Actions**

**Weight Management** discuss weight management if BMI >25 and consider referral to local Weight Management Programmes if BMI > 28 (lower thresholds if non-Caucasian). See NICE Obesity guidance.

**HbA1c**: targets should be individualised. (NICE 2022) offers a helpful aid to target setting. Review lifestyle & medications. Refer to hospital specialist teams if recurrent, problematic or severe hypoglycaemia or for insulin initiation.

**Awareness & Management of Hypoglycaemia** should be assessed at each annual review. Consider the Gold Score of delayed hypoglycaemia awareness of hypo onset:

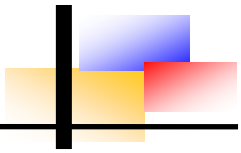
Fully aware 1 2 3 4 5 6 7 Fully unaware

**eGFR**: if reduced, review medications. Consider specialist referral if eGFR < 45 (CKD G3b) or if deteriorating at > 2 ml/min/year or if ACR raised (see below).

**Urine ACR**: consider referral for specialist assessment if ACR > 3.0 (x2) unless you're confident to manage it. Refer all patients with ACR ≥ 30 (x2) (overt nephropathy).

**Non-fasting lipids**: see Topic 7.
**Hypertension**: see Topic 6..
**Microalbuminuria or Nephropathy**: see Topic 12
**Retinopathy or visual problems**: consider referral to ophthalmologist if recommended by accredited screening programme if not referred directly to ophthalmologist by scheme).

# Topic 5: Diabetes and Driving



****N.B. People with diabetes must inform their motor insurance company**

***DVLA guidance about diabetes and driving is reviewed regularly. We therefore strongly recommend that you consult the website for the latest advice.***

https://www.gov.uk/diabetes-driving

## *Essentially:*

Insulin-treated patients must inform the DVLA, must monitor blood glucose and take appropriate action, must recognise warning symptoms of hypoglycaemia and must meet required visual standards. In addition, they must not have any other conditions (e.g. neuropathy leading to loss of joint position sense) that would compromise safe driving – see website.

**Temporary Insulin Treatment**

E.g. gestational diabetes & post-myocardial infarction. Patients may retain licence but should stop driving if experiencing disabling hypoglycaemia. Notify DVLA again if treatment continues for more than 3 months – see website.

**Diet & Tablets**

Patients will be able to retain "Till 70 licence" unless develop relevant disabilities e.g. diabetic eye problems affecting visual acuity or visual field or if insulin required. In the absence of complications, diet and tablet-treated patients need not routinely inform the DVLA – see website.

**GLP-1 Analogs & oral drugs combined with Sulfonylurea**

**– see website.**

**Group 2 Entitlement (LGV & PCV) & other special licences**

**– see website.**

**Diabetic Complications, (including Hypoglycaemia)**

**– see website.**

# Topic 6: Diagnosis and Management of Hypertension in Diabetes

NICE BP Guidance was updated August 2019 – it details how to undertake the recommendations outlined below – it's complicated.

**Diagnosis**

- Measure BP as per NICE (it's very detailed). "BP"= clinic BP
- If BP 140/90 to 180/120, offer ambulatory blood pressure monitoring (ABPM) or home blood pressure monitoring (HBPM) to confirm diagnosis of hypertension & perform investigations for target organ damage and formal risk assessment.
- Hypertension = (clinic) BP ≥ 140/90 **plus** ABPM (daytime average) or HBPM average ≥ 135/85.
- If initial BP > 180/120 & no relevant symptoms or signs, investigate for target organ damage ASAP (and if target organ damage – TREAT). If initial BP > 180/120 plus retinal haemorrhage or papilloedema or new confusion, chest pain, heart failure or acute kidney injury refer urgently (same day).

**Treatment**

Offer lifestyle (see NICE) interventions to all patients.

Stage 1 = BP 140/90 to 159/99 **plus** ABPM/HBPM 135/85 to 149/94
Stage 2 = BP 160/100 to 179/119 **plus** ABPM/HBPM ≥ 150/95
Stage 3 = BP ≥ 180/120

Target organ damage = LVH, CKD, BP↑ retinopathy or ↑ ACR
White coat effect = > 20/10 difference between (clinic) BP and ABPM or HBPM

**Typical targets (use judgement, especially in frail)**

| | **Age < 80** | **Age ≥ 80** | **Nephropathy** |
|---|---|---|---|
| **BP** | < 140/90 | < 150/90 | < 130/80 |
| **ABPM / HBPM** | < 135/85 | < 145/85 | < 125/75 |

| | **Step 1** | **Step 2** | **Step3** | **Step 4** |
|---|---|---|---|---|
| People with Diabetes | ARB or long-acting ACE | Add CCB or Thiazide-like diuretic | Add CCB or thiazide-like diuretic (whichever not used in Step 2 | Consider specialist advice unless expertise in BP management |

# Topic 7: Diagnosis and Management of Dyslipidaemia in Diabetes (see NICE)

## Primary Prevention

- Do QRISK3 score and consider treatment if 10 yr CV risk is ≥ 10%
- Consider treatment at lower threshold if BMI>40, HIV, Trigs 4.5-9.9, severe mental health disease, antipsychotics, steroids, immunosuppressants or deprivation
- Consider treatment without QRISK3 score if age ≥ 85; TIDM & Age ≥40 yr or T1DM & Duration ≥10 yr or T1DM & ↑CV risk factors; or eGFR > 60; or ACR ↑

1. Check full lipids & ALT. Prescribe ATORVASTATIN 20 mg nocte if ALT < 3x ULN
2. STOP statin if ALT > 3 x ULN at any stage. If intolerant, try alternative statin.
3. If still statin-intolerant, prescribe EZETIMIBE 10 mg od
4. Repeat full lipid profile & ALT after 3 months Rx.
5. If non-HDL cholesterol fall ≥ 40%, continue Rx.

- If non-HDL cholesterol fall < 40% on statin, titrate statin dose until fall ≥ 40%. If fall < 40% fall on max ATORVA, add Ezetimibe 10 mg od
- Refer Specialist Lipid Clinic if non-HDL cholesterol fall < 40% on ATORVA 80 + EZETIMIBE 10
- If non-HDL chol fall <40%, statin-intolerant & on Ezetimibe, add Bempadoic acid.
- Refer Specialist Lipid Clinic if fall < 40% on EZETIMIBE + BEMPADOIC acid

## Secondary Prevention

- In the absence of contraindications, treat CAD, CVD or symptomatic PAD ASAP.

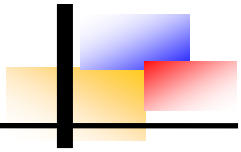
1. Check full lipid profile & ALT
2. Consider prescribing ATORVASTATIN 80 mg nocte if ALT <3xULN
3. Repeat full lipid profile and ALT after 3 months Rx.
4. STOP statin if ALT > 3 x ULN at any stage
5. If non-HDL cholesterol fall < 40% (or non-HDL-C > 2.5 if no baseline) on ATORVA 80, add EZETIMIBE 10 mg od.
6. Repeat full lipid profile and ALT after 3 months combination Rx.
7. If non-HDL cholesterol fall < 40% (or non-HDL-C > 2.5 if no baseline) on ATORVA 80 + EZETIMIBE 10 mg od. Refer to Special Lipid Clinic.

## Triglycerides

- If non-fasting Trigs > 20 and not diabetes or alcohol, refer urgently to lipid clinic.
- If non-fasting 10-20, repeat fasting in 1-2 weeks. If not 2° to some obvious cause, refer to Lipid Clinic.
- If Trigs 4.5-9.9, repeat fasting. Manage 2° causes (e.g. ↑ HbA1c). Manage CV risk. Refer to Lipid Clinic if non-HDL-Chol > 7.5.

1. If ASCVD & taking a statin and LDL-C between 1.04 - 2.6 and Trigs > 1.7, consider Icosapentyl Ether.

# Topic 8: Aspirin & Antiplatelet Therapy in Diabetes



## *Secondary Prevention of Atherosclerotic Vascular Disease (ASCVD)*

Use of antiplatelet therapy in known pre-existing vascular disease (ASCVD) is associated with improved outcomes (whether or not the person has diabetes). In the absence of contraindications, after 'acute' therapy, patients should receive antiplatelet therapy as dictated by their specific condition and circumstances. This is typically guided by a cardiologist, a stroke physician or a vascular surgeon.

## *Primary Prevention of Vascular Disease*

Do **NOT** routinely prescribe ASPIRIN (or other antiplatelet agents) for the primary prevention of vascular disease in diabetes (NICE 2015 & 2022).

# Topic 9: Insulins and Oral hypoglycaemic Agents in Type 1 Diabetes

In Type 1 diabetes, we typically use basal-bolus treatment. Twice daily mixtures are NOT routinely recommended (NICE 2022) (though some patients prefer two rather than four injections).

Continuous Subcutaneous Insulin Infusion ("PUMPs") may be suitable for some Type 1 patients and is offered at local hospitals. STHK has a large pump service offering a range of pump options, including so-called hybrid closed loop systems.

Insulin initiation is typically undertaken by a hospital team – structured education and intensive post-insulin-start support for patients is a critical element of insulin initiation. If this cannot be assured in primary care, refer to the hospital team.

**N.B.** Safer insulin guidance recommends prescribing insulin by brand (i.e. non-generic) names and for prescriptions delivery device should be specified. Do NOT use abbreviations 'u' or 'iu'.

## *Basal Bolus Regimen*

Use a short-acting analog (e.g. Trurapi) 15 minutes before breakfast, lunch & evening meal, together with a longer-acting insulin (e.g. Toujeo). Use acquisition cost to guide choice (but note there may not be complete dose-equivalence). NICE says biosimilars are an acceptable alternative if acquisition cost is lower. Exceptionally, human insulin, e.g. Humulin S or Actrapid may be useful.

## *Insulin + Oral Hypoglycaemic Agents*

In the absence of contraindications, consider addition of METFORMIN to insulin in T1DM if body mass index (BMI) > 25 (23 in Asians).

## *Insulin in Pregnancy & Preconception*

See Topic 11.

## *Insulin Dose Adjustment in Adults*

Patients are taught to self-adjust. Increments and decrements must be individualised. Guidance is available on some hospital websites e.g. St Helens & Knowsley Teaching Hospitals (search 'diabetes').

# Topic 10: Oral hypoglycaemic Agents (OHAs), GLP-1 agonists & insulins in Type 2 Diabetes

NICE Type 2 guidance (2022) and Joint American (ADA) and European guidance (EASD) guidance (2022) are more concordant than previously, though they still differ in some important respects.

**ASCVD**=coronary artery disease, acute coronary syndromes, previous MI, stable angina, coronary or other revascularisation, ischaemic stroke or TIA, or peripheral arterial disease.

**High CV risk** QRISK 3 score ≥ 10% if age > 40 or an elevated lifetime risk defined as 1 or more CV risk factors developed before age < 40, where CV risk factors=BP↑, dyslipidaemia, smoking, obesity, FH *premature* CVD in first degree relative.

**CHF**=chronic heart failure.

**CKD**= eGFR<60 and ACR > 3.0.

**First line treatment**

1. If symptomatic of BG↑, consider insulin or sulfonylurea (rescue treatment), then review when BG controlled.

2. In all cases, in the absence of contraindications, offer Metformin plain (MR if GI disturbance) and establish tolerability. Monitor B12 periodically (MHRA).

3. Assess for ASCVD, high CV risk, CHF and CKD (see above definitions).

4. If Metformin tolerated and ASCVD or CHF or CKD with ACR >30, in the absence of contraindications, offer addition of appropriate SGLT2 inhibitor (e.g. Dapagliflozin 10 mg daily) to Metformin.

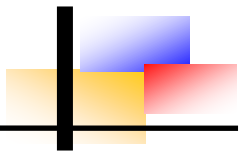
5. If Metformin tolerated and no ASCVD, CHF or CKD with ACR >30, but high CV risk or CKD with ACR 3-30, consider adding appropriate SGLT2 inhibitor (e.g. Dapagliflozin 10mg daily) to Metformin.

6. If Metformin intolerant and ASCVD or CHF or CKD with ACR >30, in the absence of contraindications, offer appropriate SGLT2 inhibitor as monotherapy (e.g. Dapagliflozin 10mg daily).

7. If Metformin intolerant and high CV risk or CKD with ACR 3-30, consider adding using appropriate SGLT2 inhibitor ((e.g. Dapagliflozin 10mg daily) as monotherapy.

8. If no ASCVD, not high CV risk, no CHF and no CKD, continue Metformin monotherapy, unless HbA1c > target or other reason to change.

# Topic 10: Oral hypoglycaemic Agents (OHAs), GLP-1 agonists and insulins in Type 2 Diabetes



## Continued from Page 13

**Further treatment**

9. If subsequently symptomatic of BG↑ (at any stage), consider insulin or sulfonylurea (rescue treatment), then review when BG controlled.

10. If at any point, patient develops ASCVD or CHF or high CV risk or CKD - see (4), (5), (6) and (7) above.

11. If on Metformin or Metformin plus appropriate SGLT2 inhibitor as above and HbA1c above personalised target, consider further lifestyle intensification (including potentially bariatric surgery), a DPP-4 inhibitor (e.g. Linagliptin 5mg daily), Pioglitazone, an SGLT2 inhibitor (if not on one), a Sulfonylurea (e.g. Gliclazide), a GLP-1 agonist (e.g. Semaglutide SC) or Insulin.

    You must engage the patient in a detailed conversation informed by their diabetes, their personal health, their considerations and preferences and a suitably detailed discussion of each of the above alternatives therapies to facilitate fully informed patient choice about treatment intensification.

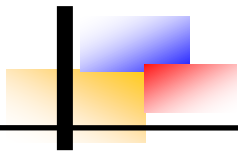
    Treatment for Type 2 diabetes has become increasingly complex and personalised in recent years.

    If in doubt, seek specialist review.

**Important Note**

There is a current national shortage of all GLP-1 RAs which is forecast to last at least until mid-2024. National guidance is NOT to initiate patients on these drugs and for pre-existing patient s, not to switch between GLP-1 RAs. This means that at least until mid-2024, we will not be able to offer GLP-1 RAs as a treatment option for Type 2 diabetes and existing patients who cannot get a supply of their drug may need to choose between using them intermittently (with associated potential swings in glycaemia and associated complications) or move to an alternative treatment, which for many is likely to be insulin.

# Topic 11: Contraception, Conception and Pregnancy



***Contraception***

Most modern forms of contraception are typically acceptable in diabetes; some gestagens carry increased venous thromboembolic risk – combined oral contraceptive pills using lowest practicable dose of oestrogen and lower risk gestagens are preferable.

***Conception***

Diabetes is associated with substantially increased risks to mother and baby, including greatly increased risk of congenital malformations. Near-normal glycaemic control at or near conception is likely to reduce these increased risks.

Women with diabetes contemplating pregnancy should be referred without delay to the specialist team for pre-conception management.

***Pregnancy & Labour***

People with pre-existing diabetes and gestational diabetes should usually be seen by the specialist team, as early in pregnancy as possible. Typically, pregnancy and labour are jointly managed by diabetes specialists and obstetricians. Many women need insulin, but it should be noted that Metformin may be used in some patients (specialist use only).

***Gestational Diabetes***

Numerous different criteria made this confusing in the past. NICE NG3 recommends the WHO guidelines for diagnosis of diabetes in pregnancy:

| | |
|---|---|
| Fasting | ≥ 5.6 mM |
| Post-prandial (e.g. 2 hr OGTT) | ≥ 7.8 mM |

Targets for Glycaemic Control during Pregnancy

Target HbA1c for pre-conception and pregnancy is ≤ 48 mmol/mol. Targets for SBGM set by patient and diabetes specialist. Typically, pre-meal BMs 3.5-5.3 mM and 1-hr post-prandial BMs <7.8 mM or 2-hr post-prandial BMs < 6.4mM. Keep BM > 4.0 if insulin treatment.

Prescribe Aspirin 150mg daily in T1DM and T2DM from 12 to 36 weeks gestation.

Current national guidelines recommend FOLIC ACID 5mg daily for women with diabetes from 3 months pre-conception to 12 weeks gestation.

# Topic 12: Diabetic Microalbuminuria and Nephropathy

Untreated, diabetic proteinuria (nephropathy) is associated with high risk of progression to renal failure and high risk of cardiovascular morbidity and premature mortality.

Albumin to creatinine ratio (ACR) on 'first pass' early morning MSSU sample sent to the hospital laboratory is the method of choice for detecting and quantifying proteinuria. If 1 ACR is raised, repeat twice more within 3-4 months.

Consider alternative diagnosis if no retinopathy, blood pressure particularly high, sudden-onset proteinuria, significant haematuria or systemic ill health.

***Definitions***

NORMAL = ACR < 3.0 mg/mmol in men & women

MICROALBUMINURIA = (**2** x) ACR 3.0 – 30 men & women

NEPHROPATHY = (**2** x) ACR > 30 men & women

***Management***

See NICE (RAAS = renin-angiotensin-aldosterone system blockade e.g. ACE- or ARB)

In the absence of contraindications, there are 8 key (individualised) interventions:

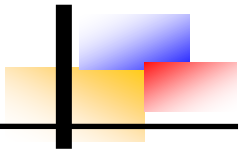
1. BP < 130/80 (125/75 for ABPM or HBPM; higher target in frail elderly) (Topic 6)
2. RAAS blockade: Use max tolerated ARB or generic long-acting ACE-inhibitor.
3. SGLT2 inhibitor treatment
4. Non-steroidal mineralocorticoid receptor antagonist (fineronone) if eligible
5. Statin therapy (see Topic 7).
6. Aspirin 75 mg o.d therapy (**only if known vascular disease**).
7. Good glycaemic control, typically HbA1c < 53 mmol/mol (see Topics 9 & 10) but should be individualised.
8. Smoking cessation

**N.B.** RAAS blockade should be used even if the BP is 'normal'.
Statins should be used even if the cholesterol is 'normal' (see Topic 7).
Patients with reduced eGFR often need additional measures.
Patients with Type 2 on maximum tolerated RAAS blockade, should be considered for SGLT2 inhibitor treatment for reno-protection, particularly if ACR > 30.

-consider referral to appropriate specialist

**Note:** All medications should be reviewed and monitored very carefully in CKD and AKI, particularly when the eGFR falls below certain thresholds: 60, 45 and 30.

# Topic 13: Diabetes & Endoscopy or Radiology



Diabetic patients needing endoscopic or radiological investigations may have to fast, modify their diet or receive intravenous contrast media.

For information see also JBDS 2016 guidance.

***Summary of Common Situations and Actions for diabetes medications***

| | **MF alone** | **MF+ any other glucose lowering agent(s)** | **SU or Pioglit or gliptin or SGLT2 or combination** | **Insulin[4] or GLP or both** |
|---|---|---|---|---|
| **SMBG** | No | Pt. should monitor BMs closely & seek help if problems if taking SU or Insulin or SGLT2 or GLP | | |
| **IV Contrast?** | Stop MF | Stop MF<br>Review SGLT2<br>Continue others | Review SGLT2<br>Continue others | Continue |
| **Bowel Prep.?** | Continue meds | Continue meds<br><br>Use "Build Up" or other substitute for CHO as required. | Continue meds<br><br>Use "Build Up" or other substitute for CHO as required. | Continue meds<br><br>Use "Build Up" or other substitute for CHO as required. |
| **Overnight fast?** | No problem | Hypo risk<br><br>Use "Lucozade" or other substitute for CHO as required. | Hypo risk<br><br>Use "Lucozade" or other substitute for CHO as required. | Hypo risk<br><br>Use "Lucozade" or other substitute for CHO as required. |
| | | | | |

**Notes**

1. MF=Metformin, SU=sulfonylurea, Pioglit=Pioglitazone, SGLT2=sodium glucose co-transporter 2 inhibitor, GLP=glucagon-like peptide 1 mimetic; BM=self-monitored capillary blood glucose (SMBG), Hypo=hypoglycaemic episode, CHO=carbohydrate.
2. Metformin should be stopped 48hr before intravenous contrast and not restarted until post-procedure serum creatinine confirmed 'normal'.
3. SGLT2 inhibitors may cause volume depletion.
4. Emergency endoscopies etc should be performed with patient on GKI (see Topic 20c) regardless of T1DM or T2DM.
5. May need dose adjustment – if in doubt phone DNS for advice.

# Topic 14: Diabetic Neuropathies & Foot Care

Diabetes foot care is the subject of specific NWCSCN guidance – see laura.hand2@nhs.net.

There are many forms of neuropathy in diabetes, only the most common are discussed here.

***Chronic Sensorimotor Neuropathy***

Common: usually symmetrical numbness, skin changes and variable motor weakness in feet; predisposes to foot ulceration. No specific treatment. Aim for good glycaemic control & education re footcare (Community Foot Screening Programme – increased risk) together with appropriate footwear to try to prevent foot ulceration.

***Diabetic Peripheral Painful Neuropathy (DPN)***

After diagnosis of neuropathic pain & together with management of underlying condition (see NICE guideline on neuropathic pain in adults):

- Offer a choice of Amitriptyline, Duloxetine, Gabapentin or Pregabalin as initial treatment for neuropathic pain. Use good prescribing principles as with all drugs. Review early and adjust dosage. Some local guidelines specify an order in which the drugs should ideally be used. Adverse effects are common.

- If initial treatment is ineffective at maximum tolerated dose, offer one of the remaining 3 drugs or consider additive treatment (combination treatment is more effective than monotherapy). Seek side effects.

- Consider Tramadol only if acute rescue therapy is needed.

- Consider Capsaicin cream (0.075% Axsain) for people with localised neuropathic pain who wish to avoid or who cannot tolerate oral treatments.

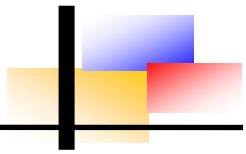
Consider referring the patient to a Specialist Pain Service or condition-specific service (e.g. Vascular Surgery) at any stage, including initial presentation and at the regular clinical reviews, if:

- They have severe pain, or
- Pain significantly limits their daily activities and participation, or
- Their underlying health condition has deteriorated

***Autonomic Diabetic Neuropathy***

Postural hypotension, recurrent vomiting (gastroparesis), recurrent severe diarrhoea, nocturnal diarrhoea, urinary retention, unexplained bladder-emptying and gustatory sweating may result from diabetic autonomic neuropathy, typically in longstanding diabetes. Always ask & if suspected, referral to the Hospital Specialist Diabetes Team for assessment and management is recommended.

# Topic 15: Out of Hospital Hypoglycaemia



Hypoglycaemia typically manifests as hunger, sweating, tremor, headache (and/or a host of other symptoms), with or without confusion and reduced conscious level in association with a blood sugar, typically < 4.0 mM. Some patients suffer seizures during hypoglycaemia and some develop (reversible) hemiparesis.

Hypoglycaemia awareness and management should be assessed as part of annual review in T1DM (NICE ). We recommend the Gold Score (see Topic 4).

***Oral Treatment***

In cases of mild hypoglycaemia, Glucose (e.g. 5 dextrosol, 5 jelly babies or a standard mug (200ml) of a sugary drink e.g. full sugar Coke is the best treatment for hypo, but 200 ml of fresh orange juice, or sugary (3 sugars) tea are ok.

A rapidly absorbable sugary solution is available (DEXTROGEL). This may be used in semiconscious patients (who can still protect airway) if parenteral treatment and emergency help is not available (not in unconscious patients).

If short-acting carbohydrate (as above) is used then it should be followed up by more complex carbohydrate (such as a sandwich) to prevent further hypoglycaemia.

Strive for a BM $\geq$ 8.0 mM before discharging the patient from close monitoring and clinical supervision.

***If Patient can't take Carbohydrate by mouth***

If the patient is unable to take oral carbohydrate then:

1 mg of glucagon may be given IM or IV while awaiting an ambulance (999). Glucagon may cause headache & vomiting (especially in young – consider 0.5 mg in teenagers).

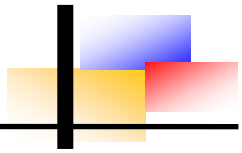
Sulfonylurea-induced hypoglycaemia may require prolonged treatment and supervision – refer urgently for hospital admission.

***Subsequent Management***

Severe hypoglycaemia is often recurrent – after one episode people are particularly susceptible to further hypo over the next few days or more. After an episode of severe hypoglycaemia, patients should be advised to run their sugars higher (say 8-15 mM) for a week or two and should avoid driving or other situations where hypo would put them or others at risk

→ referral to the Hospital Specialist Diabetes Team is recommended.

# Topic 16: Consider referral to Consultant-led Adult Specialist Diabetes Services



**NOTE**: Precise criteria may vary slightly from area to area.

Diabetes & pregnancy (T1DM or T2DM)
Diabetes in pregnancy (GDM)
Diabetes & planning pregnancy
Young people (18-25 yr) with diabetes (refer to Young Adults Clinic – Dr Balafshan)
Newly diagnosed T1DM
Patients with severe, unexplained or recurrent hypo
Patients with hypo unawareness or delayed awareness (Gold score ≥4)
Patients wishing to be considered for Insulin Pump Therapy
Patients with Type 1 or 2 who want and meet criteria for CGM (use CGM form)
Patients for structured education (use education form)
Patients where differentiation between T1DM & T2DM is in doubt
Maturity onset diabetes of the Young (MODY)
Problematic painful neuropathy
Autonomic neuropathy
Neuropathic or neuroischaemic foot ulceration
Diabetes + ACR > 30 (unless specific expertise in Diabetic Nephropathy Mx)
Diabetes + eGFR < 45 (CKD Stage 3B) where ACR is raised (see above). If ACR normal, refer to Nephrologist for investigation.
Persistent poorly controlled diabetes despite appropriate guideline-led primary care treatment (Please follow steps in guidance first).
New or suspected Charcot
Diabetes & sight-threatening retinopathy
Patients for consideration for GLP 1 agonist treatment
Patients for consideration for Insulin treatment

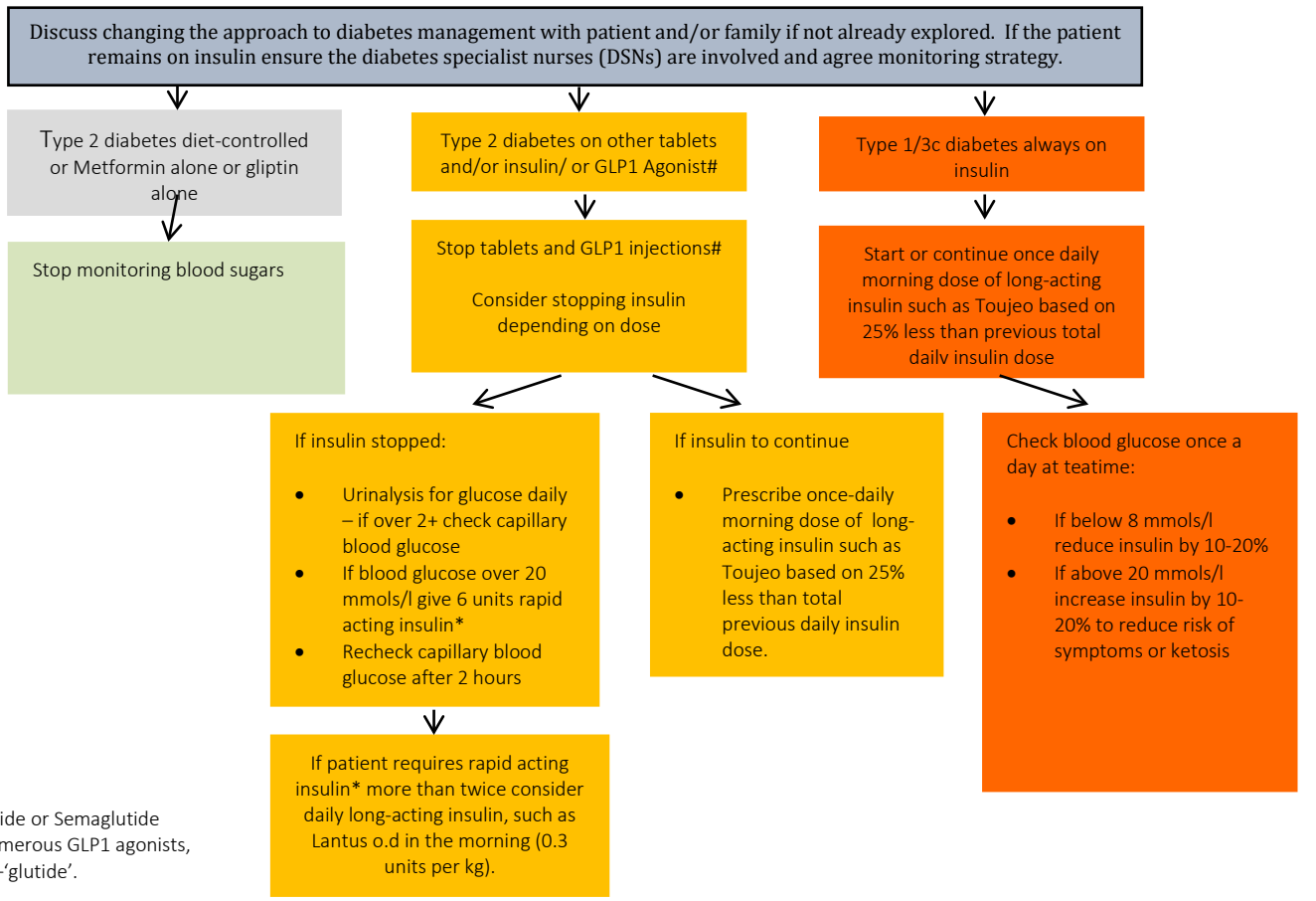
# Topic 17: End of Life Care & Diabetes

Detailed guidance on End-of-Life Diabetes Care, including for example managing diabetes with steroid treatment and managing hypoglycaemia is beyond the scope of this guideline, but is available from Diabetes UK.

**Glucose targets**: Symptomatic control is the priority, typically 6-15.

**Preventative treatments**: Review need for: Aspirin, Clopidogrel, Antihypertensives & Reno-protective drugs, Ferrous compounds, Vit D analogs and Statins...

**Glucose Treatment**:




Key

# e.g. Liraglutide or Semaglutide (there are numerous GLP1 agonists, all ending in –'glutide'.

*e.g. Apidra

^e.g. Humulin I

Long-acting insulins include: Lantus, Humulin I, Toujeo, Tresiba

# Topic 18a: Inpatient care of people with Diabetes

- Check blood glucose (BG) in all Pts with diabetes within 30 min of hospital arrival.
- Check blood ketone within 30 minutes of arrival in all emergency attendances if BG >11.1 or pH < 7.3 or HCO3- < 15 mmol/l or on SGLT2 inhibitor (gliflozin) treatment.
- Blood ketones (not urine) – use finger prick or lab sample. Don't restart SGLT2i until blood ketones normal. Seek urgent medical assessment if blood ketones ≥ 3.0 mM.
- All diabetes admissions should have a documented foot examination as part of initial assessment and must have one within 24 hours of decision to admit.
- Don't use PRN insulin & don't use 'u' or 'iu' - state 'units'. Insulin must only be delivered by specific insulin syringe or insulin pen and NEVER by ordinary syringe.
- If a person wants to self-manage, knows how to and is currently able to do so – please support them to self-manage – they usually know their diabetes.
- Use Inpatient Diabetes Chart. If BMs mostly 6-12, do QDS (pre-breakfast, pre-lunch, pre-tea, pre-bed (wake patient if sleeping at test time)) twice weekly. If unstable or unsure, do QDS daily. Take timely ACTION if results out of range.
- If it is DKA (Topic 26) or HHS (Topic 27) please manage as per these guidelines.
- If patient's BGs are largely above 6-12, **ACTION** is needed. Make appropriate changes to treatment and if the problem persists for ≥ 3 days, refer to diabetes inpatient specialist nurses (IP DSN). If recurrent or severe hypo or DKA, refer within 24hr to IP DSN.

**Stable**

- Eating & BMs 6-12, continue usual management.
- Eating, BM >12, ketones 0.6-1.5, consider TDS fast-acting insulin (Topic 20b) & use sugar-free oral fluids 100ml/hr. BM & ketones 4hrly, 'til ketones < 0.6
- Eating, BM >12, ketones 1.5-3.0, consider TDS fast-acting insulin (Topic 20b) & use sugar-free oral fluids 100ml/hr & do BM, ketones & venous bicarb 2hrly, until ketones <0.6.
- Eating, BM >12, ketones >3.0, but not acidotic, give Fast-acting insulin 0.1 units per kg s.c. 2-hrly & sugar-free oral fluids 100ml/hr. Test BM, ketones & venous bicarb 2hrly, until ketones <0.6 and BM <12. If acidotic = DKA Mx (Topic 26).

**Unstable**

- Type 2, not eating, BMs 6-12, continue present treatment (consider hypo risk).
- Type 1 (or doubt) & not eating & BMs 6-12, use GKI (Topic 20d)
- Type 1 & not eating & BMs > 12, ketones <0.6, use GKI or VRII (Topic 20).
- All: if BM >12, ketones >1.6 & unwell, consider DKA plan (Topic 26).
- Refer all DKA, recurrent or severe hypoglycaemia, new Type 1, diabetic foot ulceration and red bullets to IP Specialist Diabetes Team without delay.

# Topic 18b: Inpatient diabetes monitoring charts

## Monitoring capillary blood glucose & blood ketones

Attach patient addressograph label here

Name:
Hospital Number:
Date of Birth:

Date: …/…/…… Ward: ……

St Helens and Knowsley Teaching Hospitals NHS Trust

### Inpatient Blood Glucose Monitoring Chart

Inpatient blood glucose target: 6.0 -12.0 mmol/L, for monitoring frequency and management of blood glucose readings outside this range refer to Diabetes Inpatient Guidance (up to date policy on intranet)

- If blood glucose <4mmol/L: manage as per hypoglycaemia policy (HYPO BOX), record on hypoglycaemia event table
- If blood glucose >15mmol/L: Check urine/serum ketones, if present and/or patient systemically unwell, seek medical advice. Consider referral to in-patient diabetes team using CareFlow Connect

**Blood glucose readings (plus ketones as per inpatient guidance)**

| Date | …/…/… | | …/…/… | | …/…/… | | …/…/… | | …/…/… | | …/…/… | | …/…/… | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BG | Ket. | BG | Ket. | BG | Ket. | BG | Ket. | BG | Ket. | BG | Ket. | BG | Ket. |
| Pre-breakfast | | | | | | | | | | | | | | |
| Pre-Lunch | | | | | | | | | | | | | | |
| Pre-Evening Meal | | | | | | | | | | | | | | |
| Pre-Bed | | | | | | | | | | | | | | |

All insulin must be administered by an approved insulin pen device or by an insulin syringe. DO NOT draw out of insulin cartridges or insulin pen devices.

If requiring IV insulin infusions or more frequent monitoring for another reason, please use hourly blood monitoring chart. In the event of DKA, use the Adult DKA Clinical Management Pathway Booklet.

**Hypoglycaemic Event 1**

| Date: …/…/… | BG | Treatment given/ Escalation |
|---|---|---|
| Time: …:… | | |
| 15 min. repeat | | |
| 30 min. repeat | | |
| 45 min. repeat | | |
| Additional | | |

**Hypoglycaemic Event 2**

| Date: …/…/… | BG | Treatment given/ Escalation |
|---|---|---|
| Time: …:… | | |
| 15 min. repeat | | |
| 30 min. repeat | | |
| 45 min. repeat | | |
| Additional | | |

**Hypoglycaemic Event 3**

| Date: …/…/… | BG | Treatment given/ Escalation |
|---|---|---|
| Time: …:… | | |
| 15 min. repeat | | |
| 30 min. repeat | | |
| 45 min. repeat | | |
| Additional | | |

BG Monitoring Chart, Version 2, H Sullivan, S Michaels, P Narayanan: Review Date 01.01.2025

## Management of Blood Ketones

St Helens and Knowsley Teaching Hospitals NHS Trust

Blood Ketone levels should be checked on a finger prick sample using a blood ketone meter.
**Check blood ketones if the patient is unwell and BM>15 mmol/L or unwell and on an SGLT2 Inhibitor (Gliflozin medication)**

| | < 0.6 mmol | 0.6 – 1.5 mmol | 1.6 – 3.0 mmol | ≥ 3.0 mmol |
|---|---|---|---|---|
| | Readings below 0.6mmol/l are in the normal range | This may indicate a problem developing | | Seek URGENT Medical Advice |
| **Action** | **Normal**<br>Usual diabetes management for that Patient | **Slightly raised**<br>Give sugary oral fluids 100 ml/hr or food & TDS Humulin S (see Topic 20b) | **High risk of imminent DKA**<br>Do VBG, U&E, Lab BG & seek urgent Specialist Registrar advice (see Topic 26) | **High likelihood of DKA**<br>Do VBG, U&E, Lab BG & seek urgent Specialist Registrar advice (see Topic 26) |

**Why?**

Raised blood ketones are an indication that insulin levels are low and counterregulatory hormones (principally glucagon) are high resulting in fat breakdown. In the presence of adequate insulin, giving carbohydrate switches off fat breakdown and ketone production. Fluids enhance ketone clearance.

**When blood ketones are markedly raised they cause harmful acidosis (DKA). IV insulin switches off ketone production and IV fluids promote renal ketone clearance**

**What next?**

The aim of blood (glucose and) ketone monitoring is to detect any deterioration early to allow timely treatment to prevent DKA and other harm. A normal blood ketone level in someone who is unwell and has a raised sugar provides reassurance that they are not developing DKA. A raised blood ketone level is an alert that timely intervention to prevent deterioration and ongoing monitoring are essential. Don't delay – follow this guidance and act. There is detailed guidance on the Trust website – search 'Diabetes' and 'STHK Adult Diabetes Guidelines 2023-2028'. If you're unsure what to do, seek help immediately.

# Topic 19: If you don't know patient's usual insulin(s) or dose(s)

Sometimes, patients who use insulin are admitted to hospital, but are unable state their insulin brand or doses….and you don't know if any documented doses are current or historical.

Only use uncorroborated records if the dates of these records are recent.

If insulin details cannot be established, refer to the Inpatient Diabetes Specialist Nurses as soon as possible.

Please include patient details, location, reason for referral and name of referrer.

If IP DSN review is not available before next insulin dose is due:

- If usual insulin brand is not known- use TDS Humulin S insulin as per inpatient guidelines (see Topic 20b). *Patients must not be discharged on TDS Humulin S. If further support is needed, refer to Inpatient Diabetes Specialist Nurses.*

- If insulin brand is known, but doses are not known- use weight-based formula:

- If on multiple doses of insulin (Type 1 or Type 2 diabetes), use 0.5 units per Kg total dose:

    1. If on BD mixed insulin - split 2/3 AM and 1/3 PM
       e.g. Weight 60kg, then 0.5 units per Kg = 30 units total daily dose;
       Give Pre breakfast 20 units (2/3) and Pre tea 10 units (1/3)

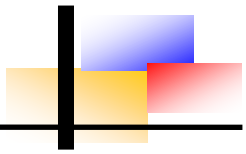
    2. If on Basal-Bolus regimen – give 50% as basal and 50% split equally between the 3 pre-meal doses. e.g. Weight 60 kg, then 0.5 units per Kg = 30 units total daily dose:
       Basal insulin 15 units (50%) and Short/rapid acting insulin 5 units before each meal (5+5+5 = 15 (50%).

- If on once-daily long-acting insulin injection (type 2 diabetes), use 0.3 units per kg

    e.g. Weight 100kg, then 0.3 units per Kg = 30 units total daily dose:
    Basal insulin 30 units at 'bedtime'.

**Please record in the patient's notes that the doses have been calculated from patient's weight as a temporary measure until current usual doses can be identified.**

# Topic 20a: TDS soluble vs FRII vs VRII vs GKI



There is no robust evidence or NICE guidance on choice of temporary subcutaneous insulin regimens or intravenous insulin in inpatients with diabetes and practice varies.

Our priority ladder (in order) is SAFETY · EFFICACY · SIMPLICITY · COST

**TDS Soluble**

Where intravenous cannulation can be avoided this is preferable – there is less risk of local and systemic infection (e.g. MRSA bacteraemia) and its easier for patients. Hence the use of TDS soluble insulin in stable patients with high sugars who are eating (see Topic 18a).

**FRII (fixed rate insulin infusion)**

Until the 1970s, diabetic ketoacidosis (DKA) was treated with large doses of intravenous insulin and the incidence of hypoglycaemia and hypokalaemia was very high and harm was common.

Subsequently in DKA, it was shown that low-dose intravenous insulin (initially 0.1 units/kg/hr) was as effective but caused dramatically less hypoglycaemia and hypokalaemia; and globally the initial insulin infusion dose was 0.1 units/kg/hr. This was then typically halved (0.05 units/kg/hr) when in the recovery phase when BG reached 10-15.

Some years ago, the JBDS recommended maintaining the insulin dose at 0.1 units/kg/hr throughout DKA treatment (initial and recovery phases) - so-called *fixed rate insulin infusion* or 'FRII'. At STHK, as in the USA and elsewhere, we continued to reduce the insulin infusion rate in the recovery phase (once the BG reached 10-15) because the lower insulin infusion rate provides more than enough insulin to completely suppress glucose production and ketogenesis (total suppression at 0.015 units/kg/hr) and avoids the very real risk of increased hypoglycaemia and hypokalaemia.

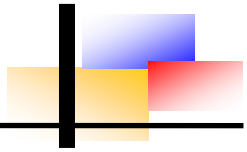
In 2022, JBDS acknowledged an increased risk of hypoglycaemia and hypokalaemia with FRII and now recommends considering reducing the infusion rate (as per USA and STHK), but confusingly, JBDS continues to call this non-fixed insulin infusion, FRII.

**VRII** (variable rate insulin infusion)

Variable rate insulin infusion is an effective method for delivering intravenous insulin to stabilise blood glucose in people who are unstable and not eating.

Its major advantage over GKI is that the dose is very easily adjusted by changing the infusion rate on the IV insulin pump. Its major disadvantage is that because the insulin and IV glucose are delivered from separate sources, if the insulin pump fails or runs-out, the person gets unopposed glucose and is at risk of potentially life-threatening DKA and if the glucose

## Topic 20a: TDS soluble vs FRII vs VRII vs GKI



## (Continued from page 24)

infusion fails or runs-out the person gets unopposed intravenous insulin and is at risk of hypoglycaemic brain injury and death.

In intensively monitored areas, risks are likely to be small (but still happen). In less intensively monitored areas, risks are substantial. VRII also requires 2 x as many pumps, (in short supply at Whiston); and there is a risk of hypokalaemia if potassium is not monitored and consciously added when needed to the glucose infusion.

**GKI** (glucose potassium insulin infusion)

GKI is an intravenous insulin infusion where insulin and glucose are in the same bag (with potassium as required). It was developed in the UK in the 1980s for use in surgery where it typically kept BG in target range throughout the entire peri-operative period in over 80% of patients. Its success in surgery led to more widespread use in inpatients with diabetes.

GKI was designed as a glucose-maintaining regimen. To use it to lower blood glucose is illogical because it involves giving IV glucose to someone who is hyperglycaemic. It's also less flexible because the whole bag must be changed if the insulin dose (infusion) is changed. Its major advantage, however, is that because the insulin and glucose are in the same bag, it is impossible to give unopposed glucose or unopposed insulin – this is much safer, particularly in less intensively monitored areas, such as general wards.

**We recommend:**

- TDS soluble insulin for BG control in people who are stable and able to eat, but are problematically hyperglycaemic (Topic 20b)

- 24-unit GKI over FRII or VRII in the recovery phase of DKA management (Topic 26) because having insulin and glucose in the same bag is equally effective and safer.

- 16-unit GKI over VRII on general wards (incl. pre- and post-surgery) for glucose maintenance (Topic 20d) because having insulin and glucose in the same bag is equally effective and safer.

- VRII for correction of hyperglycaemia in unstable patients in intensively monitored areas where clinicians are completely confident that monitoring is sufficiently frequent and intensive to safely manage VRII (Topic 20c).

  If in doubt, transfer the patient to an appropriately intensively monitored area and use VRII, or if this is not possible, use GKI (Topic 20d).

# Topic 20b: TDS Soluble Insulin

## *TDS Soluble Insulin*

Whether T1DM or T2DM, & usually diet, tablet or insulin-treated, if sugars are unstable or high & patient is eating and well, TDS soluble insulin (e.g. Humulin S) is useful to establish blood glucose control short-term.

Aggressive dose titration is essential to achieve control.

**If rapid correction is desirable, use IV insulin infusion by pump (VRII – Topic 20c).**

**TDS Soluble Insulin TYPICAL STARTING DOSE**

Use a weight-based calculation to determine starting dose.

- Total daily dose = 0.5 units/kg
- Divide total daily dose by 3 to determine TDS dose

For example, for a 60 kg patient:

Total daily dose = 0.5 units/kg = 30 units

**Give 10 units TDS before meals**.

Give insulin TDS 30 min. before meals and monitor BMs. Adjust often and aggressively until BMs largely 6-12 mM.

If no progress after 72 hr ask IP Diabetes Specialist Team to review.

# Topic 20c: VRII Intravenous Insulin Infusion

## *VRII (variable rate Intravenous Insulin Infusion)*

IV insulin is the quickest, most effective way to control (lower) blood sugar. GKI is arguably safer in less intensively monitored areas for maintaining stable sugars (see Topic 20a). Only use VRII and when you are assured that monitoring is sufficiently intensive to prevent potential hazards (see Topic 20a).

For VRII, use pre-filled insulin syringes if possible. They are stock on: A&E (Resus & Observation Ward), 1B, 1C, 1E, 3C, 4E and in the emergency cupboard. If pre-filled syringes are unavailable make up a 50 ml syringe with 50 units of soluble insulin (e.g. HUMULIN S) in 49.5 ml of 0.9% saline. This makes a concentration of 1 unit per ml.

Hourly blood glucose measurements MUST be done to reduce the very real risk of hypoglycaemia. If blood glucose is not measured hourly, then this protocol is not safe.

As per national consensus, continue long- and intermediate- acting insulins, such as Lantus, Levemir, Toujeo, Tresiba, Insulatard & Humulin I.

Check U&E (potassium) frequently and regularly until you are assured that it is stable and satisfactory. We would recommend 4-hourly U&E initially.

**Insulin Starting Point**

Start IV insulin at 0.1 units / kg / hour (i.e. 7 units / hour for 70 kg patient). Monitor BMs hourly.

**Insulin Infusion Adjustment**

| Bedside Capillary Blood Glucose (mmol/l) | VRII Insulin Infusion Adjustment (units per hour) |
|---|---|
| < 4.0 | Stop insulin & give 100ml 20% dextrose IV stat.<br>Resume after 30 min at half previous rate if IV insulin infusion still required (if not switch to TDS soluble insulin (Topic 20b) |
| 6.0 – 12.0 | Continue VRII at current infusion rate. |
| > 12.0 | If higher than the last test, increase by 2 units / hour<br>If same as the last test, increase by 1 unit / hour<br>If lower than the last test, keep at the same rate |

## *Converting to Subcutaneous Insulin*

**PLEASE NOTE**: You MUST continue IV insulin pump for 30-60 minutes AFTER first injection of soluble insulin (alone or in a mixture).

# Topic 20d: GKI (Glucose-Potassium-Insulin Infusion)

GKI is an extremely efficient method for MAINTAINING blood glucose.

## *Standard GKI*

Add 16 units soluble insulin (e.g. Humulin S) to 500 ml 10% dextrose with 10 mmol potassium chloride (KCL) & infuse at 80 ml/hr. New bags every 6 hr - dictated by glucose and U&E taken 5 hr after a bag was started (i.e. 1 hr before new bag needed):

| Plasma Glucose | Soluble Insulin added to new bag | Plasma K | KCL in new bag (pre-mixed bags) |
|---|---|---|---|
| 6-12 | Same as last bag | 3.5-5.0 | 10 mmol |
| <6 | 4 units less | < 3.5 | 20 mmol |
| > 12 | 4 units more | > 5.0 | 0 mmol |

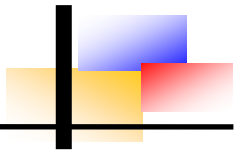
1-2 hourly BMs alert staff to unusual insulin sensitivity or resistance. They are unnecessary once the patient is clearly stable on a particular regimen. Continue long- and intermediate-acting insulins, e.g. Lantus, Levemir, Toujeo, Tresiba, Insuman basal & Humulin I. Note: in insulin-sensitive patients (requiring only small doses of s.c. insulin) lower insulin doses may be required; in insulin-resistant states (e.g. post-DKA or HHS) higher insulin doses may be required (and here we typically start with a 24-unit GKI).

If patient goes hypo (BG < 4.0) on GKI, suspend GKI, treat hypo as per Topic 28 and then start a fresh GKI with 4 units less insulin, once blood glucose has risen to ≥ 8.0 mmol/l.

## *Converting to Subcutaneous Insulin*

**PLEASE NOTE**: You MUST continue GKI for 30-60 minutes AFTER first sc injection of soluble insulin (alone or in a mixture). See Topic 29a for patients treated by CSII (subcutaneous insulin pump therapy).

# Topic 21: Diabetes & Surgery



Management of adults with diabetes undergoing surgery and elective procedures has been addressed by UK national guideline. We recommend you follow the link below and study these guidelines.

Suspend SGLT inhibitor treatment at least 4 days before elective surgery (FDA recommendation) and routinely monitor blood ketones in SGLT2 inhibitor-treated patients. Only restart SGLT2i when blood ketones normal.

JBDS Surgical Guidance January 2023: https://abcd.care/resource/jbds-03-management-adults-diabetes-undergoing-surgery-and-elective-procedures-improving

Note: this was up up to date at March 2023 - you should check to see if the JBDS has updated its surgical guidance and use the relevant up to date guidance.

## *Pre-operative assessment*

Consider referral to GP if HbA1c > 69 mmol/mol (8.5%), or to Diabetes Specialist Team if urgent (e.g. cancer surgery) or if the patient has hypo-unawareness or autonomic neuropathy.

# Topic 22: Management of Blood Glucose in Diabetes in Acute Coronary Syndromes (ACS) & Stroke

## *Blood Glucose in AMI and ACS*

Robust evidence to guide optimal management of hyperglycaemia in patients admitted to hospital for an acute coronary syndrome (ACS) is lacking. Whilst avoiding sustained hyperglycaemia appears to be of benefit, the optimal regimen to achieve this is not clear. Additionally, hypoglycaemia may be particularly detrimental, as may be the fluid load associated with GKI.

Suspend SGLT2 inhibitor treatment and routinely monitor blood ketones in SGLT2 inhibitor treated patients. Only restart SGLT2i when blood ketones normal.

Until new evidence resolves this issue, we recommend the following:

### *Aim to keep blood glucose levels 6-12 mmol/litre*

- Treat sustained hyperglycaemia while avoiding hypoglycaemia.
- If eating use TDS soluble insulin (e.g. Humulin S) (Topic 20b), preceded if necessary by IV insulin infusion (VRII) (Topic 20c) if severely hyperglycaemic (> 15 mmol/l).
- If not eating, consider a dose-adjusted insulin infusion (VRII) to achieve and maintain blood glucose 6-12 mmol/L with regular monitoring of blood glucose levels (see Topic 20a & 20b: VRII Intravenous Insulin Infusion Pump).

## *Tests for Diabetes*

Identifying patients with hyperglycaemia after ACS who are at high risk of developing diabetes. Offer all patients with ACS-associated hyperglycaemia and without known diabetes:

- Outpatient HbA1c. If HbA1c $\geq$ 48 mmol/mol (6.5%) x 2 (can be done on same sample), then notify GP that patient has newly diagnosed T2DM. Does not require diabetes specialist team referral.

Do not routinely offer oral glucose tolerance tests to patients with hyperglycaemia after ACS.

## *Acute Stroke*

There is no specific national guidance on managing hyperglycaemia in acute stroke, but the principles outlined above for AMI and ACS might reasonably be applied to acute stroke.

# Topic 23: Diabetes & Enteral Feeding (For TPN, ask IPDSN)

Patients on enteral feeding often experience high sugars and high sodium - most require temporary insulin to stabilise blood glucose and to prevent HHS.

You MUST monitor blood glucose 4-6 hourly on and off the feed and you MUST check blood sodium daily. You MUST take steps to control blood glucose and you MUST prevent hypernatraemia with appropriate hydration. This is vital to prevent HHS and the very high risk of premature death associated with severe hypernatraemia.

**Usual Medications** Suspend all oral hypoglycaemics except plain Metformin. Prescribe this in liquid form and give via NG, NJ or PEG at usual dose/times. Existing insulin should continue but the regimen may need changing.

**Temporary Insulin** Consider starting temporary insulin if capillary BGs >12mmol/l. Refer to Inpatient Diabetes Specialist Nurses (DSNs) without delay.

**Insulin Calculation** Total daily insulin dose = 0.5units/kg: give 50% as once daily basal insulin (Toujeo) at bedtime, & give 50% as fast-acting insulin (Apidra), divided equally into bolus injections dictated by feed duration:

For continuous feeds, in addition to once daily Toujeo (0.25 units/kg):

- 10 hr feed: give Apidra bolus at time 0 and 5 hrs after start (each bolus = 0.125 units/kg).
- 12 hr feed: give Apidra bolus at time 0, 4 and 8 hrs after start (each bolus = 0.08 units/kg).
- 15 hr feed: give Apidra bolus at time 0, 5 and 10 hrs after start (each bolus = 0.08 units/kg).

e.g. Patient of 60 kg on 10 hr continuous feed:

Prescribe Insulin Toujeo, 0.25 units per kg once daily (0.25 x 60) = 15 units at once daily at bedtime; and prescribe Insulin Apidra, 0.125 units per kg at times 0 & 5 hr (0.125 x 60 for each dose) = 8 units at time 0 and 8 units at time 5 hours.

If bolus feed chosen, you must discuss required insulin dose with inpatient DSN before initiating feeds. Hypernatraemia & HHS appear to be more common with bolus feeding.

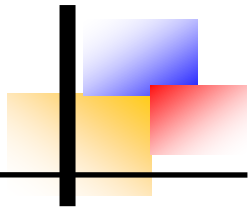
**Monitoring** Monitor capillary BG every 4-6 hours, on & off enteral feed. Target = 6-12mmol/l. If capillary BG persistently >12mmol/l, contact IP DSN. If BG >15mmol/l & unwell, check blood ketone and escalate.

**Insulin titration** Adjust insulin doses every 24-72 hr, until BG mostly 6-12mmol/l.

**Feed suspended** Do not omit Toujeo Insulin. Only give Apidra Insulin if patient is to get the enteral feed. If enteral feed stopped early – monitor for hypo and treat as per Hypo Box algorithm. Escalate if persistent or recurrent

**Review/Discontinue** If plan is to stop enteral feed, contact Inpatient Diabetes Specialist Nurses for advice about ongoing management.

# Topic 24: Management of Blood Glucose & Diabetes in inpatient COVID19 infection



## *What is known?*

- After adjustment for age, race and other risk factors, compared with non-diabetics, people with diabetes appear to be 3-4 x more likely to be hospitalised and 3-4x more likely to suffer severe COVID illness.
- Hyperglycaemia on admission (and subsequently) is associated with a poorer outcome.
- Some authorities report increased COVID-associated DKA and HHS.
- Dexamethasone treatment can increase blood sugars in those with and without diabetes.

## *What is not known*

- Whether measures to improve blood sugar control during admissions with COVID improve COVID outcomes.

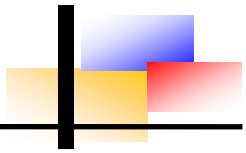
## *Glycaemic management in inpatients with COVID-19*

Despite a paucity of high-quality evidence, it is reasonable to take reasonable steps to prevent excessive hyper- and hypo- glycaemia in inpatients with COVID-19, to avoid drugs that might make things worse and to monitor for and manage dexamethasone-induced dysglycaemia. Management of blood glucose in people with diabetes and COVID within the Trust has not raised any significant concerns and we would encourage people to continue to use existing trust guidance on the management of dysglycaemia. If these measures are ineffective in an individual, then you may wish to consider the so-called "National Diabetes Inpatient COVID-19 Response Team" advice (click on link):

1. 'Front door' guidance.
2. Guidance on dexamethasone treatment and management of blood glucose.

Manage DKA/HHS and other aspects of diabetes as before (see this guideline).

# Topic 25: Management of IP Diabetic Foot Ulceration



1. All patients with diabetes in whom a decision to admit to hospital is made should have a documented foot examination as part of their initial assessment & must have one within 24 hr of admission.

2. All patients with diabetic foot ulceration should have detailed description (with measurements and ideally photographs) of ulcers within 4 hours of detection. All ulcers must routinely be swabbed for MRSA (see Infection Control Policy).

3. All patients with foot ulceration that is not healing or appears infected to have antibiotics within 6 hr of admission (check previous MRSA status if possible).

4. All inpatients with diabetic foot ulceration to be referred to specialist diabetes team within 24 hr of admission.

5. All inpatients with diabetic foot ulceration to be seen by specialist diabetes foot team within 72 hr of admission.

## *Referrals*

- Predominantly neuropathic ulceration below the malleoli - refer to **Diabetes Foot Ulcer Clinic (Dr Niall Furlong – see Topic 30).**

- Predominantly ischaemic ulceration, critical ischaemia, intermittent claudication or ischaemic rest pain – refer urgently to **Vascular Team**.

- Traumatic ulceration & in-growing toenails - refer to General Surgery.

- Ulceration on or above the malleoli - refer to **Dermatology Clinic**.

- Use the MWL Whiston Adult Inpatient Diabetes Foot Pathway (diabetes intranet homepage) to guide initial assessment, management and referral / triage.

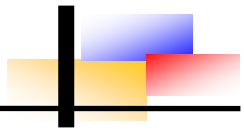
## *Antibiotics*

Not all foot ulceration requires antibiotics but if in doubt start antibiotics guided by microbiology advice and seek expert review.

Level B – use antibiotics. First line antibiotics for diabetic foot ulceration is guided by current edition of hospital antibiotic policy – please consult this policy for guidance.

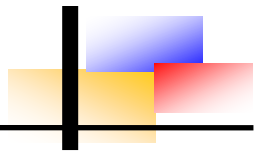
**See Hospital Antibiotic Policy for details.**

# Topic 26: Management of Adult Diabetic Ketoacidosis (DKA)



| | |
|---|---|
| ***Diagnosis*** | Usually some of: polyuria, polydipsia, thirst, weight loss, vomiting, dehydration, drowsiness, abdominal pain, and hyperventilation |
| **AND** | **pH < 7.3 or $HCO_3$ < 15 mM + ketonaemia ≥ 3 mM + BG > 11 mmol/l (patients on SGLT2i (gliflozin) treatment may have normal BG).** |
| ***Management*** | ***USE DKA BOOKLET available in A&E & AMU to record care*** |
| **Treatment** | Start fluids immediately DKA confirmed (gases + venous BG). Start insulin once gas machine confirms $K^+$ >3.5 mmol/l. If $K^+$ < 3.5 mmol/l, hold insulin until K+ > 3.5. If treatment delay, always discuss immediately with Senior. |
| **Clinical** | Confirm diagnosis, seek cause, assess CVS/RS/CNS. Refer Critical Care if age<25, >65 yr, pregnant, heart failure, AKI, serious co-morbidities, ketonaemia >6 mM, $HCO_3^-$ <5 mM, pH <7.1, $K^+$ <3.5 mM, GCS <12, $O_2$ sat <92%, anion gap >16, SBP <90, or HR <60 or >100. |
| **Laboratory** | Check BG, U&E, venous blood gas, urinalysis & blood ketone. Do ECG. Have low threshold for MSSU, Chest X-ray & Blood Cultures. |
| **General** | Add Enoxaparin 40 mg o.d. (if not contraindicated). Monitor GCS+NEWS2. Do NOT use bicarbonate for DKA. STOP SGLT2i & GLP-RA permanently. |
| **Fluids** | Fluid replacement dictated by hydration & CV status. Use 0.9% saline. If SBP <90mmHg, give 500ml over 15 mins. Typically, then give 1L over 1 hr, 1L over 2 hr and 1L over 4 hr. Adjust rate & volume of fluids to hydration status and co-existent states e.g. AKI or ACS/Heart Failure etc. |
| **Potassium** | Await K+ result before using KCL. Use 0.9% saline pre-constituted bags. Don't add KCl yourself. If K+ > 5.5 mM use bag with nil KCl; if K+ 3.5-5.5 mM use bag with 40 mmol KCl per litre; if K+ <3.5 mM, consult senior & halt insulin infusion for 30 mins. Max KCL infusion rate = 20 mmol/hr. |
| **Insulin** | Give 1 x (STAT) dose of 0.3 units/kg insulin Toujeo **subcutaneously** once DKA confirmed AND HUMULIN S pre-filled syringe (50 units HUMULIN S in 49.5ml 0.9% saline=1 unit/ml) IV. Start IV infusion pump at 0.1 units/kg/hour. If BG fall < 3 mM/hr or blood ketone fall < 0.5 mmol/l/hr after 1 hr, increase IV insulin by 1 unit/hr every hour until these are achieved. |
| **VRII & return to SC** | When BG 6-12 mM, start 24-unit GKI (Topic 20a for FRII vs GKI. Adjust GKI insulin by replacing bag as necessary (Topic 20c). Resume s/c long-acting insulin at usual time and dose on day after admission; resume other insulins when well, pH >7.3 & blood ketones falling. For CSII ("pump") therapy, there must be 2-hr overlap and a mealtime bolus before stopping GKI. |
| **Monitoring** | Hourly capillary BG & ketones. U&E & serum bicarbonate 2 hourly x 6 hr, then 4-hourly. Venous pH at 6 hr. Senior review within 14 hr of admission. |
| **Aftercare** | Review CVS/CNS daily. Assess for complications. Re-education - refer all DKA patients to Diabetes Specialist Team without delay (Topic 30). |

# Topic 27: Management of Hyperosmolar Hyperglycaemic State (HHS)



***Discussion*** For detailed discussion of management of HHS and HHS/DKA hybrid, see 2022 JBDS-IP: https://onlinelibrary.wiley.com/doi/10.1111/dme.15005

***Diagnosis*** HHS should not be diagnosed using biochemical parameters alone. Dehydrated & unwell + BG ≥ 30 mM + pH ≥ 7.3 + HCO3 ≥ 15 mM + ketonaemia ≤ 3 mM with Serum Osm ≥ 320 (Osm = [2x[Na]+BG + Urea)

***Management*** Confirm diagnosis, seek cause, assess CVS/RS/Feet/CNS. Start treatment.

**Laboratory** BG, U&E, Gases, Blood Ketones, Lactate (see monitoring below of frequency of testing), Urinalysis, MSSU, ECG, CXR & blood cultures.

**General** **Refer all patients to Critical Care for monitoring**. Low threshold for: NGT/antibiotics. Give Enoxaparin 40 mg o.d. until discharge. High risk of pressure ulcers: examination must include feet. Monitor GCS & NEWS2.

**Fluids** Fluid replacement guided by hydration & CV/renal status. Usual losses = 100-220ml/kg: replace half in first 12 hr & half in 2nd 12 hr. Use 0.9% saline. Start infusion at 1L/hr. Aim for BG fall of 3-5 mM/hr & osmolality fall of 3-8 mOsm/kg/hr; fall of plasma sodium should not exceed 10 mmol in 24 hr. Adjust fluid replacement to achieve these goals. If osmolality falls by < 4-6 mM/hr (averaged over 4 hr) consult senior.

**Potassium** Await K+ result before using added KCL. Use pre-constituted 0.9% saline bags. Don't add KCl yourself. If K+ > 5.5 mM use bag with nil KCl; if K+3.5-5.5 mM use bag with 40 mmol KCl per litre; if K+ <3.5 or >6.0mM, consult senior & halt insulin infusion for 30 mins if K+<3.5. Max potassium infusion rate = 20 mmol/hr. Monitor ECG at this infusion rate.

**Insulin** Continue long-acting S/C insulins. DO NOT start insulin infusion initially if blood ketones < 3mmol/l. Start insulin when BG no longer falling with fluids alone or if ketones >3.0. Use HUMULIN S (pre-filled syringe) IV infusion via pump (50 units HUMULIN S in 49.5 ml 0.9% saline i.e. 1 unit/ml) at 0.05 units/kg/hour (i.e. 3.5 units per hour for 70 kg man). Aim to reduce BG by 3-5 mM per hour. If glucose not falling on insulin infusion, ensure fluid replacements is adequate and double insulin infusion to 0.1 units/kg/hr. Use insulin infusion immediately if blood ketones > 3mmol/l.

**GKI** When BG 6-12 mM, stop insulin pump & use 24-unit GKI (Topic 20d). Continue simultaneous saline infusion until rehydrated.

**Monitoring** 0-6 hr, monitor hourly lab BG, U&E and osmolality; 6-12 hr monitor same 2-hourly and 12-24 monitor same 4-hourly. Review all aspects of clinical management at frequent intervals.

**Aftercare** Review CVS/CNS & feet daily. Assess for complications. Re-education -refer all HHS patients to Diabetes Specialist Team (Topic 30) without delay.

# Topic 28: Management of In-Hospital HYPOglycaemia

Hypoglycaemia typically manifests as hunger, sweating, tremor, headache ± confusion & ↓ conscious level, with BG typically < 4.0 mM. Some patients suffer seizures or reversible hemiparesis.

1. Give all patients fast-acting carbohydrate ASAP & always within 15 mins of finding low BG.

2. Monitor BG every 15 mins for at least 45 mins and until blood glucose BG >8.0 mmol/L (whichever is longer). Thereafter, use judgement about frequency (don't just stop - think).

3. If BG still < 4.0 mmol/L after 45 mins or hypo is recurrent (>2 distinct hypos in 24hr) or severe (causing confusion, seizures or coma), care MUST be escalated to a doctor or IP Diabetes Specialist Nurse without delay (out of hours, ask on call medical registrar).

4. Cause of low blood glucose, ongoing diabetes management plan and any follow-up should be discussed with patient before discharge.

***Oral Treatment***

In cases of mild hypo, give Glucose via ward hypo box, (5x Glucotabs or 60 ml Glucojuice). Alternatives would be 5 jelly babies or 200 ml full-sugar Coke, 200 ml fresh orange juice, or sugary (5 sugars) tea.

2 tubes of GLUCOBOOST (= 20g glucose) (via the ward hypo box) may be used in semiconscious patients who can still protect airway if parenteral treatment and emergency help not available. Do not use GLUCOBOOST in unconscious patients.

If short-acting carbohydrate (as above) used, it should be followed up by more complex carbohydrate (such as a sandwich) to prevent further hypoglycaemia.

***If Patient can't take Carbohydrate by mouth, give either***

IV glucose, ideally use 20g of 20% (100 ml) by IV infusion over 10-15 min (but 20g of 10% (200 ml) or 20g of 5% (400 ml) will suffice if higher concentration solution unavailable and if volume of IV fluid is judged safe for this patient. Repeat infusion if BG does not rise > 4.0 mmol/L. Monitor as per oral.

1 mg of glucagon may be given IM or IV where IV glucose is unavailable. Glucagon may cause headache and vomiting (especially in young – consider 0.5 mg in teenagers).

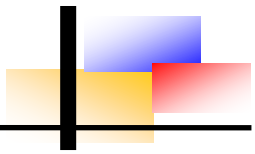
Sulfonylurea-induced hypoglycaemia may require prolonged treatment and supervision – refer to specialist diabetes care.

***Subsequent Management***

Severe hypoglycaemia is often recurrent over a few days or more. After severe hypoglycaemia, advise patient to run their sugars higher (say 8-15 mM) for 1-2 weeks and to avoid driving or situations where hypo would put them or others at risk. **Referral to the Hospital Specialist Diabetes Team is recommended**.

**Hypo boxes are available in most clinical/ward areas and contents should be checked and topped up daily as required.**

# Topic 29a: Continuous Subcutaneous Insulin (Pumps)



**Background** Insulin pumps are small, pager-size, external devices in type 1 diabetes used to stabilise blood glucose control. Rapid-acting insulin (e.g. Novorapid) is delivered subcutaneously by an indwelling cannula (changed every 2-3 days) at pre-programmed rates set by the patient or specialist team. Typically there are one or more 'basal rates' augmented by mealtime boluses.

**Important** As insulin pumps only administer rapid-acting insulin, discontinuation without alternative provision of insulin, can rapidly result in DKA. Inform the Diabetes Team if a patient using as insulin pump is admitted.

**Education** Patients receive intensive education in pump use and inpatients should ideally be allowed to self-manage if stable and well enough to do so. Pump settings should only be adjusted by the patient or the Diabetes Team.

**Unwell patients** If the patient is not well enough to self-manage, or is unconscious / incapacitated, the pump should be removed (and safely stored) with insulin administered via a different route; typically GKI or VRII (Topic 20) or basal-bolus therapy. A pump should **NEVER** be discontinued without immediate substitution of insulin via another route and must only be restarted when the patient is well and able to self-mange (contact the IP Diabetes Team for advice).

**DKA** If an insulin pump user is admitted with DKA, the pump should be removed (and safely stored) & the patient treated with IV insulin / fluids etc. as per Topic 26. When the patient is well and able to self-manage, insulin pump therapy can be restarted with a new cannula, giving set and reservoir.

**Restarting pump** When changing from GKI or VRII to s.c. insulin e.g. pump therapy, IV insulin must CONTINUE until the pump has been running for 30-60 minutes *and* a mealtime bolus has been given **(2 hour overlap post DKA).**

**Hypoglycaemia** For patients able to self-manage, give 20g quick-acting carbohydrate orally (Topic 28). Follow-up with long-acting carbohydrate may not be needed, but infusion rates may need adjusting, particularly if hypoglycaemia is recurrent (contact the Diabetes Team for advice). For unconscious / incapacitated patients, use IV dextrose (ideally 100ml 20% dextrose over 15 mins). Remove the pump if hypoglycaemia is persistent AND only restart insulin pump therapy when blood glucose has returned to normal and the patient is well and able to self-manage (see Topic 28).

**Radiological tests** Insulin pumps must be suspended and removed prior to MRI, and not taken into the scanning room (removal for CT also advised). Pumps can be safely suspended / removed for up to 1 hour without alternative insulin but should be restarted **immediately** following the investigation. Check capillary BG before and after procedure.

**Surgery** **See Topic 21. Contact the diabetes team for advice.**

# Topic 29b: Recognising Insulin Pumps & Continuous Glucose Monitors (CGM)

**Background**

Increasingly, patients with diabetes mellitus use advanced technology to (1) monitor glucose levels and (2) to deliver insulin. For patients with T1DM (and some T2DM), 'traditional' finger-prick testing is being replaced by continuous glucose monitoring (GCM).

Whilst most insulin-treated patients still use pen devices to inject insulin, Type 1 patients now often use insulin pumps.

**Glucose Monitoring**

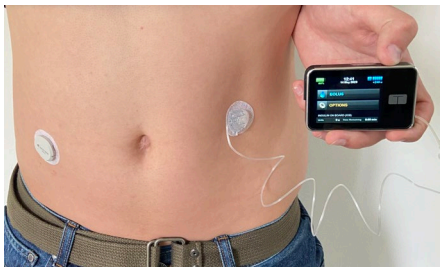
Continuous glucose monitoring (CGM) systems use a small sensor worn on the skin with a subcutaneous sensor that monitors interstitial glucose. Some systems require the sensor to be scanned with a reader device or mobile phone to give a glucose reading (intermittently scanned CGM or isCGM, e.g. Freestyle Libre2), whilst others automatically send glucose data to the reader or phone rtCGM (e.g. Dexcom CGM). Libre 2 with smartphone is rtCGM from 1st July 2023.

Freestyle Libre2

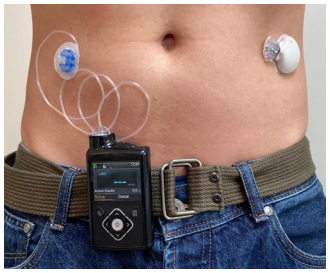
**Insulin pumps**

These devices can be 'tethered' (i.e. attached to the patient with tubing) or 'tubeless' (patch pumps). Insulin pumps deliver rapid-acting insulin (e.g. NovoRapid) subcutaneously at pre-programmed rates set by the patient or specialist team via an indwelling cannula, augmented by mealtime boluses. The delivery system is typically changed every 2-3 days. Some insulin pumps can integrate with CGM to automatically adjust insulin doses according to glucose levels. This is called Hybrid Close Loop (HCL).

Omnipod (patch pump) with handset

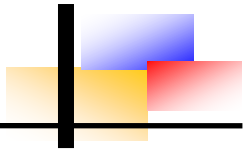


Tandem Slim insulin pump with Dexcom CGM sensor



Medtronic insulin pump with CGM sensor

# Topic 30: Contacting Specialist Diabetes Services for Inpatients



The Diabetes Specialist Team provides management support (advice and consultations) to secondary care teams providing inpatient care to people with diabetes (e.g. surgical patients), including diabetes nurse specialist (DSN), registrar and consultant review.

For DSN inpatient referrals please use current referral process – this can be found on the Diabetes Inpatient Care page on the intranet.

For Consultant referrals please indicate whether IP or OP review is required (use Diabetes referral form for OP referrals), written consultant-consultant referrals should be emailed to InpatientReferrals.endo-diabetes@sthk.nhs.uk.

For emergency advice use the Diabetes Emergency Advice Line 01744 646200 option 5.

There is also ongoing diabetes specialist care for the small number of patients admitted to hospital with diabetes-related problems that require ongoing specialist input (e.g. medical management of severely infected diabetic foot ulcers).

**Consultant Advice**: Diabetes Consultants can be contacted through their secretaries, who typically know whether they are available to take a call and will connect you:

Dr Sumudu Bujawansa – Sarah.Henderson@sthk.nhs.uk or 01744 646497

Dr Prakash Narayanan – Michele.Wynn@sthk.nhs.uk or 01744-646500

Dr Sid McNulty – Lynn.Parry@sthk.nhs.uk or 01744-646758

Dr Niall Furlong – Michele.Wynn@sthk.nhs.uk or 01744-646500

Dr Tala Balafshan – Thea.McCarten@sthk.nhs.uk or 01744 646502

Dr Sam Westall – TBC from October

Dr Ei ThuzarAung -TBC from October

Mrs Jan Cardwell (Nurse Consultant) Sarah.Henderson@sthk.nhs.uk or 01744 646497

Dr Heather Sullivan - Michele.Wynn@sthk.nhs.uk or 01744-646500

Prof. Kevin Hardy (OP only) – Sarah.Henderson@sthk.nhs.uk or 01744-646497

**Email**: The diabetes consultants are accessible by email.

**Letter**: slower than telephone and email but available for those who prefer it.

## MONITORING COMPLIANCE WITH THIS DOCUMENT

### Key performance Indicators of the Policy

| Describe Key Performance Indicators (KPIs) Must reflect | Frequency of Review | Lead |
|---|---|---|
| Compliance in the use of the Adult Diabetes Guidelines (Inpatient chapters) within STHK Hospital Trust. | Monthly | Sue Michaels |
| | | |
| | | |
| | | |
| | | |

### Performance Management of the Policy

| Aspect of compliance or effectiveness being monitored | Monitoring method | Individual responsible for the monitoring | Frequency of the monitoring activity | Group / committee which will receive the findings / monitoring report | Group / committee / individual responsible for ensuring that the actions are completed |
|---|---|---|---|---|---|
| Evidence of compliance of the use of Adult Diabetes Guidelines in relation to inpatient diabetes care. | Ongoing review of Datix at monthly diabetes safety MDT | Sue Michaels Senior Diabetes Specialist Nurse & Diabetes IP Nursing Team Leader | Monthly | Diabetes Safety MDT to review and feedback to full MDT and Care Group Governance meeting (and thus CEC or PEC) as appropriate. | Sue Michaels |