# Diabetes Mellitus

## *Executive summary*

## Introduction

### Diabetes mellitus (DM) is a metabolic disorder characterized by chronic hyperglycemia. It predisposes to blindness, limb amputation and is a major risk factor for cardiovascular disease and death. Type 2 DM is the most common type with many patients having no symptoms and diagnosed incidentally.

This guideline covers the diagnoses and treatment of diabetes mellitus.

### Target User

* Nurses
* Doctors

### Target area of use

* Gate Clinic
* Outpatient Department
* Ward

### Key areas of focus / New additions / Changes

DM is diagnosed if fasting blood glucose is ≥ 7.0 mmol/L or random blood glucose ≥ 11.1 mmol/L with typical symptoms. Patients with newly diagnosed DM or features suggestive of complications should be referred from the Gate Clinic to the OPD. Management of DM is aimed at blood glucose control and prevention of complications using pharmacologic and non-pharmacologic measures.

Patients with type 1 DM will require lifelong insulin therapy and should be referred to EFSTH. Patients with type 2 DM will typically receive metformin alone or in combination with other drugs.

Insulin therapy should be considered in the in-patient management of DM if blood glucose is persistently > 10 mmol/l. This can be achieved by giving scheduled basal, premeal and correctional doses of insulin.

### Limitations

## This guideline does not address the management of hyperglycaemic emergencies. These are addressed in MeG-CLS-021 Diabetic ketoacidosis and MeG-CLS-046 Hyperglycaemic hyperosmolar state.

## Presenting symptoms and signs

Many patients have no symptoms and are diagnosed incidentally while being investigated or treated for some other medical condition.

Symptoms of diabetes mellitus at presentation may include:

* classic symptoms
  + increased thirst
  + increased volume and frequency of urination
  + polyphagia
* recurrent Infections
  + recurrent boils and other skin infections
  + recurrent genital infections (persistent whitish discharge with itch in women, inflammation of glans penis in men)
* unexplained abdominal pain (mimicking a surgical/acute abdomen),
* weight loss (more common in Type 1 DM)
* marked weakness
* blurred vision
* abnormal sensation in the legs and feet: pain, burning, numbness (“feels like walking on mud when barefoot”)
* foetal macrosomia
* foetal deaths

Consider the possibility of diabetes in all adults of any age with a BMI > 25 kg/m2 plus one or more of the following:

* Hypertension > 140/90 mmHg
* First degree relative with Type 2 DM
* Polycystic ovarian syndrome
* Previous history of foetal macrosomia
* Cardiovascular disease
* Previous history of impaired glucose tolerance
* Physical inactivity
* Previous diagnosis of dyslipidaemia

Consider a diagnosis of Type 1 DM if:

* Younger than 35 years
* Slim physique
* Rapid onset of symptoms
* Severe symptoms at first presentation (including DKA)

Apart from the symptoms listed earlier, complications include:

* Autonomic neuropathy: Abnormal sweating, resting tachycardia, erectile dysfunction, postural hypotension, gastrointestinal symptoms such as early satiety, nocturnal diarrhea, constipation
* Motor: Painful proximal weakness (difficulty getting up from sitting position)
* Sensory neuropathy: Bilateral distal lower limb pain,
* Vascular: leg fatigue, claudication, stroke, ischaemic heart disease.

## Management in Gate Clinic

### Investigations

Diagnose diabetes mellitus if you find:

1. ***Fasting Blood Glucose***(FBG)of 7.0 mmol/L or higher

**OR**

1. A ***random blood glucose(RBG)*** of 11.1 mmol/L or higher **plus** the classic symptoms of diabetes mellitus.

If patient is asymptomatic with abnormal fasting glucose, repeat the test for confirmation.

For staff , HbA1c may be used to confirm the diagnosis. HbA1c of 6.5% or greater is diagnostic of diabetes mellitus .

***Dipstick urinalysis:***  This may show glycosuria. Proteinuria or ketonuria may also be present.

### Alarm features

If a patient with high blood glucose has one or more of the following signs or symptoms, the doctor should be called to see them immediately.

* Drowsiness
* Fever > 38ºC
* Severe Weakness
* Confusion
* Signs of dehydration
* Deep sighing breathing
* Abdominal pain

### When to refer to the doctor in OPD

Also refer patients to the doctor who have:

* Newly diagnosed diabetes mellitus
* You are unsure of the diagnosis
* Proteinuria or ketonuria is discovered alongside high blood glucose
* Glycosuria of ++ or more
* Patient looks very ill and weak alongside a high blood glucose

### Management of patients with a high blood glucose

*Patient Education:*

Structured education to all patients and carers about diabetes mellitus (cause, course and prognosis), diabetes self-management, nutrition and lifestyle modification. This includes diet, exercise and weight management (loss of 5-10% of body weight initially).

## Management in OPD

### Routine examination

Review BMI at each visit.

Check for postural hypotension at baseline, annually and if symptomatic.

Foot exam:

* Inspect both feet at each visit for calluses, dystrophic nails, joint deformities, tinea pedis, ulcers.
* Check for reduced peripheral pulsation in feet at baseline, annually and if symptomatic.
* Baseline and annual neurologic examination of feet (10 g monofilament and 128 Hz tuning fork vibration test).

Fundoscopy for retinal changes.

### Routine investigation

*Fasting Blood Glucose* at each follow up visit

Baseline and annual *serum electrolytes, urea and creatinine*: calculate estimated glomerular filtration rate (eGFR) at <https://www.kidney.org/professionals/kdoqi/gfr_calculator>

Calculate cardiovascular risk at <https://qrisk.org/2017/> - check lipid profile if the risk is borderline (5-10% in the next 10 years).

*Urinalysis*: Glycosuria and ketonuria may be present. Proteinuria (++) or haematuria (with red cell casts) may indicate nephropathy.

Baseline *ECG*

For staff and those who can afford private fees: baseline *HbA1c assay*, recheck 6-monthly (if at target) or 3-monthly (not at target)

### Treatment

The goals of treatment are:

* Glucose control;
* Cardiovascular risk reduction;
* Prevention and management of complications.

*Lifestyle measures*: Diet, smoking cessation, moderation in alcohol intake, adequate physical activity and weight management.

*Pharmacologic Therapy:*

*Glucose control:* Target blood glucose levels are 4.4 – 7.2 mmol/l (fasting and pre-meal), less than 10.0 mmol/l post-prandial. Target HbA1c is less than 7%. Individualize higher targets for older patients, those prone to hypoglycaemia, or with multiple co-morbidities. (target up to 8.5% HbA1c and 5.0 -10.0 mmol/l pre-meal blood glucose)

* Type 1 patients: usually insulin dependent from diagnosis. Usually maintained on combinations of regular insulin and intermediate acting insulin e.g. Mixtard (70/30). Refer to EFSTH
* Initial drug of choice in Type 2 is metformin unless contraindicated. Start at 500 mg orally once daily. Increase to 500 mg twice daily the next week and then 500 mg three times daily the week after. The usual maximum dose is 1000 mg twice daily.
* For patients with baseline FBG > 16 mmol/l, baseline HbA1c ≥ 9% or FBG not at target after 3 months, commence gliclazide along with metformin.
* Assess medication adherence at each visit.
* If still not at target despite maximal doses of gliclazide and metformin, consider adding another oral agent or insulin. Patients other than staff will need to be referred to EFSTH diabetic clinic at this point.

*Hypoglycaemia:* Treat at blood glucose less than 4 mmol/l or presence of typical symptoms.

* Unlikely to occur if patient is on metformin monotherapy.
* Educate patient on prevention, symptoms and immediate care needed. Patients on sulfonylureas or insulin should carry three candies (sweets) or sugar cubes always to treat hypoglycaemia.
* If hypoglycaemia occurs, assess diet, dose and physical activity with patient and agree on dose adjustment.

*Blood pressure control:* Target BP is < 140/90 mmHg

* If BP is < 160 mmHg systolic and < 100 mmHg diastolic, start with a single drug preferably a Calcium Channel Blocker (use an ACE Inhibitor instead if proteinuria or chronic kidney disease is present)
* If BP is ≥ 160 mmHg systolic or 100 mmHg diastolic, start with two drugs preferably Calcium Channel Blocker + ACE Inhibitor
* Avoid beta blockers as they can mask hypoglycaemia symptoms

*Cholesterol:* Statin therapy with atorvastatin if patients is over 40 years or has a history of atherosclerotic cardiovascular disease. Higher doses are needed for patients with cardiovascular disease.

*Antiplatelet therapy:* consider if 10 year cardiovascular risk is > 10% – Soluble aspirin 75 mg daily or clopidogrel 75 mg daily.

Encourage patients to seek annual comprehensive eye examination at SZREC.

For distal sensory polyneuropathy, carbamazepine or amitriptyline may provide improvement in discomfort over time. Metformin may cause Vitamin B12 deficiency which may contribute to neuropathy. This may be detected as a raised MCV and can be treated with 1 ml Vitamin B12 im monthly.

*Nephropathy:* Monitor serum electrolytes, urea and creatinine if proteinuria is present (or on ACE inhibitor). Discuss referral to EFSTH if eGFR is < 60 mL/min/1.73 m2.

### Pregnancy and DM

*Pre-existing Type 2 DM:* Tight glucose control is important. If this can be achieved on Metformin alone then this can continue. The patient will need specialist obstetric care and many will need insulin treatment.

*Gestational Diabetes:*

* Lifestyle changes may be adequate for control
* Metformin is the first line therapy
* Insulin therapy may be needed.
* Refer for specialist obstetric care

## Management on the ward

All adult patients (including those not previously diagnosed diabetic) admitted to the ward should have baseline blood glucose checked.

Blood glucose > 7.8 mmol/l in an in-patient is considered as hyperglycaemia. If blood glucose is persistently > 10 mmol/l, consider starting insulin therapy with a target blood glucose of 7.8 – 10.0 mmol/l. Calculate total daily dose (TDD) in units of insulin required.

* For patients recovering from DKA, TDD may safely be set at two-thirds (2/3) of their previous total daily requirement of IV soluble insulin.
* For patients previously on insulin at home, use previous total daily dose if they were at glucose targets.
  + Otherwise, calculate TDD by multiplying body weight in kg by the factor N from the Table 1 below
  + Adjust TDD downward if nutritional intake is less than normal for patient.

*Table 1. Factor for calculating Total Daily Dose of Insulin based on weight:*

|  |  |
| --- | --- |
| **If patient has these features...** | **N =** |
| Underweight, elderly, CKD or severe liver disease | 0.3 |
| Normal-weight patients, including Type 1 diabetes. | 0.4 |
| Overweight | 0.5 |
| Obese, high-dose steroids, or other markers of significant insulin resistance. | 0.6 |

For patients who are able to eat or who are given tube feeding boluses, give half the calculated TDD as a *basal* subcutaneous insulin isophane (Insulatard) either as a single dose or as two divided doses 12 hourly. Give the other half as pre-*meal* subcutaneous soluble Insulin (Actrapid) 30 minutes before meals with the dose divided equally between the meals.

* If pre-meal blood glucose is < 3.9 mmol./l, treat for hypoglycaemia and reduce pre-meal doses of regular insulin by half.
* If pre-meal blood glucose is >10 mmol/l, add *correctional* insulin dose to pre-meal dose of regular insulin using the Table 2 below.

*Table 2. Correctional doses of insulin based on pre-meal or 6-hourly blood glucose*

|  |  |  |  |
| --- | --- | --- | --- |
| *Blood Glucose (mmol/l)* | *If TDD <40 units/day, add:* | *If TDD is 40-80 units/day, add:* | *If TDD >80 units/day, add:* |
| **< 3.9** | **Reduce dose by half & call doctor** | | |
| 4 – 10 | 0 unit | | |
| 10.1 - 11.0 | 1 unit | 2 units | 4 units |
| 11.1 - 12.5 | 2 units | 4 units | 6 units |
| 12.6 - 14.0 | 3 units | 6 units | 8 units |
| 14.1 - 16.5 | 4 units | 8 units | 10 units |
| 16.6 - 19.9 | 5 units | 10 units | 12 units |
| **20 and above** | **6 units** | **12 units** | **14 units** |
| **Call doctor after giving insulin** | | |

For patients on nil per oral (NPO) or receiving only clear fluids, give only half (50%) of the calculated TDD as *basal* isophane insulin either as a single subcutaneous doses or as two divided doses every 12 hours. These patients should also receive 5% dextrose infusion at 500 mls 4 – 6 hourly.

Check blood glucose 6 hourly. Give *correctional* dose of insulin if needed

Reassess and modify insulin therapy daily based on trends of blood glucose.

For patients who are insulin dependent at discharge, 80% of the calculated TDD of insulin given during admission should be prescribed as mixed insulin or Insulatard . Two-thirds of this dose should be taken in the morning with breakfast and one-third of the total dose at dinner .Patients should be taught self-administration of insulin , the symptoms of hypoglycaemia and what to do in the event of hypoglycaemia. Patients who are insulin dependent but are not staff of MRC should be referred to EFSTH.

## Key Issues for Nursing care

## Before administering insulin:

## Always check blood glucose

* Confirm type of insulin to be given and route

## Confirm insulin concentration (should be 100 U/ml)

## Confirm insulin syringe units (should be 100 U/ml)

## Confirm dosage before administration

## In addition, for pre-meal insulin:

## Confirm availability of food

## Confirm ability and willingness of patient to eat.

Insulin protocols for each patient should be updated daily and available at the bedside.

## References:

## Maynard G, Wesorick DH, O'Malley C, Inzucchi SE on behalf of Society of Hospital Medicine Glycemic Control Task Force. Subcutaneous insulin order sets and protocols: effective design and implementation strategies. J Hosp Med. 2008 Sep;3(5 Suppl):29-41. doi: 10.1002/jhm.354.

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