FOREWORD TO THIS EDITION

The diabetes guidelines were last reviewed in 2009. Since then the SIGN guideline for Diabetes (SIGN 116) has been published and this has necessitated alterations to the GGC guidelines to bring them into line with SIGN. I have also taken this opportunity to update the guidelines taking into account alterations in other GGC guidelines as well as responding to innovations in the management and treatment of diabetes which have occurred during this interval.

I would like to thank the following colleagues who have written new sections for the guideline. They are: Professor Miles Fisher, Dr Russell Drummond, Dr Helen Hopkinson, Dr Brian Kennon, Dr Robbie Lindsay and Mr Carl Fenelon. I wish also to recognise the contribution of Mr Carsten Mandt who prepared the various drafts of the document and helped with layout. I also wish to thank Dr Colin Semple for undertaking the final proof reading. I would also like to thank many other colleagues who have reviewed the guidelines and suggested additional alterations to the document.

Derek Gordon.
March 2012
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DEFINITION OF DIABETES MELLITUS

Diabetes mellitus is a group of conditions defined by the level of hyperglycaemia that gives rise to risk of microvascular complications (retinopathy, nephropathy and neuropathy). It is associated with reduced life expectancy, diminished quality of life, significant morbidity due to microvascular complications and also increased risk of macrovascular complications: ischaemic heart disease, stroke and peripheral vascular disease.

The main forms of diabetes mellitus are type 1 diabetes, type 2 diabetes, secondary diabetes mellitus and gestational diabetes. The terms IDDM and NIDDM should now be avoided.

TYPE 1 DIABETES

Type 1 diabetes results from an absolute deficiency of insulin due to destruction of pancreatic beta-cells. It more commonly presents acutely before the age of 35 but can occur at any age. Patients are insulin-dependent and prone to ketoacidosis.

TYPE 2 DIABETES

Type 2 diabetes results from a relative deficiency of or insensitivity to insulin (insulin resistance) combined with impaired insulin secretion and is more commonly diagnosed over the age of 35, although this can occur in younger (especially obese) individuals. Although the onset of type 2 diabetes is less dramatic than that of type 1, the long-term complications are similar and equally devastating. Both type 1 and type 2 patients are at risk of developing the microvascular and macrovascular complications of the disease. For this reason, type 2 diabetes should never be referred to as 'mild diabetes'.

SECONDARY DIABETES

Secondary diabetes is diabetes resulting from pancreatic damage, hepatic cirrhosis, endocrine disease, or developing as a result of therapy (e.g. with steroids, anti-viral, or anti-psychotic drugs).

GESTATIONAL DIABETES (GDM)

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy. Since this does not exclude that glucose intolerance may have antedated pregnancy, a post-natal OGTT should be performed.

Women with a history of GDM have a 60% chance of developing diabetes (usually type 2) within the subsequent 20 years and this risk is increased by obesity. For this reason they should be advised to control their weight and have an annual fasting glucose measurement performed. For further details, see section Diabetes in Pregnancy. Women with a history of GDM should be screened for the condition in future pregnancies.
IMPAIRED GLUCOSE TOLERANCE (IGT) AND IMPAIRED FASTING GLYCAEMIA (IFG)

IGT and IFG are not illnesses. They are risk categories (risk factors) primarily for the future development of diabetes.

IMPAIRED GLUCOSE TOLERANCE (IGT)

IGT is a state of impaired glucose homeostasis, diagnosed on the basis of a glucose tolerance test (OGTT). IGT confers an increased risk of future diabetes of 2-5% per year. IGT is also (together with hypertension, obesity and dyslipidaemia) part of the metabolic syndrome, which is associated with an increased cardiovascular risk.

IMPAIRED FASTING GLYCAEMIA (IFG)

The term IFG denotes individuals with fasting glucose values of 6.1-6.9 mmol/l. A proportion of these patients will have 2h-post load glucose concentration in the diabetic range. Therefore, the World Health Organisation (WHO) and Diabetes UK recommend that all such individuals should have an oral glucose tolerance test to exclude diabetes.

Individuals with impaired glucose tolerance or impaired fasting glycaemia should receive lifestyle advice including diet and exercise, especially if overweight and should be reviewed periodically, since many will develop diabetes and since they are at increased cardiovascular risk. Appropriate lifestyle interventions can reduce or delay the development of diabetes by two thirds. Fasting blood sugar, blood pressure and lipid profile should be checked annually. Weight loss and exercise should be encouraged if appropriate. Co-existing cardiovascular risk factors should be treated after risk assessment using an appropriate tool. Individuals with a CVD risk of 30% or more should receive suitable treatment (see appendix 5).
Consider a diagnosis of diabetes in a patient with:

- Thirst and polyuria;
- Unexplained weight loss or tiredness;
- Pruritus vulvae, balanitis or recurrent urinary tract infections;
- Recurrent infections;
- Blurring of vision (usually an osmotic effect and not permanent);
- Discoloured or ulcerated feet;
- Hypertension, ischaemic heart disease or stroke;
- Obesity, with diagnosis of arterial disease or family history of diabetes.

In such patients, it is useful to perform preliminary screening investigations i.e. random plasma glucose measurement and urinalysis for presence of glucose and ketones. Note that the diagnosis of diabetes has important medical and legal implications for the patient. A diagnosis of diabetes should not be based solely on the finding of:

- Glycosuria;
- Raised blood glucose (finger prick sample) on a 'stick' reading;
- Elevated haemoglobin A1c (HbA1c) result.

**CRITERIA FOR DIAGNOSIS OF DIABETES**

The WHO has published revised guidelines on the diagnosis of diabetes. Diabetes UK recommends that all UK health care professionals adopt these new criteria.

**Symptomatic patients:** Classic symptoms (e.g. polyuria, polydipsia, unexplained weight loss) plus one of the following:

- random plasma venous glucose concentration \( \geq 11.1 \text{ mmol/l} \); or
- fasting plasma venous glucose concentration \( \geq 7.0 \text{ mmol/l} \); or
- plasma venous glucose concentration \( > 11.1 \text{ mmol/l} \) (2 hour sample in OGTT).

Here, one diagnostic laboratory blood glucose value is sufficient. However, a reading from a glucose meter is not sufficient and a biochemistry laboratory specimen is mandatory for diagnosis.

**Asymptomatic patients:** Incidental finding of glycosuria or hyperglycaemia:

- Diagnosis should not be based on a single venous plasma glucose measurement;
- Additional testing on a separate day with a value in the diabetic range is essential (using either fasting sample or a sample taken 2 hours following glucose load);
- If fasting values are not diagnostic, the 2-hour value should be used.
Patients with elevated random plasma glucose concentration

- If random glucose is \( \geq 7.8 \text{ mmol/l} \) check fasting plasma glucose.
- If fasting plasma glucose is 6.1-6.9 mmol/l, perform OGTT.

Patients with ketonuria

If ketonuria is present with:

- Severe symptoms i.e. vomiting and dehydration, urgent hospital admission is required;
- Milder symptoms and weight loss, discuss patient urgently with the diabetes team for consideration of insulin therapy.

**ORAL GLUCOSE TOLERANCE TEST (OGTT)**

**INDICATIONS FOR OGTT**

An OGTT need only be considered to establish a degree of glucose intolerance or diabetes in patients with IFG where blood glucose values fall into an equivocal range (e.g. FPG 6.1-6.9 mmol/l). An OGTT is not necessary if the diagnostic criteria for diabetes are present.

**PERFORMING OGTT**

- Perform OGTT after at least 3 days of unrestricted diet (> 150g carbohydrate daily).
- Fast patient overnight (8-14 hours, water allowed) and rest during the test. Patient should not smoke on the day of the test.
- Take a sample for fasting blood glucose.
- Give 75g of glucose in 250-350 ml of water over a 5-minute period (some patients find that 410 mL of Lucozade Energy Original is more palatable).
- Check blood glucose after 2 hours. Samples at times other than 0 and 2 hours are not necessary for diagnosis.
- Diagnostic interpretation of OGTT is different in pregnancy.

**GLYCATED HAEMOGLOBIN (HBA1C)**

The American Diabetes Association has recently (January 2010) suggested the use of HbA1c for diagnosis of diabetes. The measurement should be standardised to the DCCT reference assay and a result \( \geq 6.5\% \) (48mmol/mol) should be used as the threshold.
for diagnosis. This recommendation remains controversial and is not recommended locally.

**Diagnostic criteria for diabetes, impaired glucose tolerance and impaired fasting glucose**

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<tr>
<th></th>
<th>Fasting plasma glucose concentration</th>
<th>Plasma glucose concentration 2 hours after 75g oral glucose</th>
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<td>Impaired fasting glycaemia (IFG)</td>
<td>6.1 – 6.9 mmol/l</td>
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<td>Impaired glucose tolerance (IGT)</td>
<td>&lt; 7.0 mmol/l</td>
<td>7.8 – 11.0 mmol/l</td>
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<tr>
<td>Diabetes mellitus</td>
<td>≥7.0 mmol/l</td>
<td>≥11.1 mmol/l</td>
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</table>
GUIDELINES FOR DIABETIC CLINIC ANNUAL REVIEW

THE FOLLOWING INFORMATION MUST BE COLLECTED AT EVERY VISIT:

- BMI;
- BP;
- Smoking habit;
- Review of medication;
- Foot examination – pulses, sensation, ulcers, infection, callus, deformity, amputation. For patients with type 2 diabetes this will be undertaken in primary care. For patients with type 1 diabetes this will be undertaken in secondary care;
- Eye examination – visual acuity, lens, retina. This will only be undertaken if the patient is not attending the retinal screening service or an ophthalmic clinic;
- Urinary albumin/protein quantification (see microalbuminuria guidelines);
- Blood sample – HbA1c, lipids, creatinine.

IN ADDITION, IT IS DESIRABLE THAT THE FOLLOWING INFORMATION IS COLLECTED (IF APPROPRIATE):

- Duration and type of diabetes;
- Osmotic symptoms;
- Method of glucose monitoring;
- Hypoglycaemic unawareness;
- Frequency of severe hypoglycaemia;
- Condition of injection sites;
- Neuropathic symptoms;
- Impotence;
- Adherence to dietary advice;
- Level of physical activity;
- Alcohol intake;
- Perception and understanding of condition;
- Psychological well-being;
- Ethnicity;
- Screening for associated auto-immune disease;
- Angina symptoms;
- Claudication symptoms;
- CHD risk quantification;
- Screening ECG/ETT;
- Co-morbidity;
  - Ischaemic heart disease/MI/CABG/angioplasty/stent;
  - Hypertension;
  - Cerebrovascular disease;
  - Peripheral vascular disease;
  - Renal failure;
  - Other.
AND FINALLY:

- Have appropriate referrals been made e.g. GP, specialist nurse, dietician, podiatrist, ophthalmologist, cardiologist, vascular surgeon, psychiatrist/psychologist?
- Have patients been offered practical support with lifestyle change e.g. exercise referral scheme?
- Consider issues regarding driving – hypoglycaemic unawareness, avoidance of hypoglycaemia and management of hypoglycaemia while driving, notification to DVLA once receiving insulin therapy.
- Pre-pregnancy advice.
- If indicated, referral should be made to an appropriate structured education programme.
REFERRAL OF PATIENTS BETWEEN PRIMARY AND SECONDARY CARE DIABETES CLINICS

This guidance was produced under the auspices of the Primary Care/Secondary Care Interface Group of the GG&C Diabetes Managed Clinical Network (MCN). The aim of the guidance is to help practitioners to determining under what circumstances patients with (type 2) diabetes should be referred from primary to secondary care and vice versa.

It is recognised that this guidance is to cover “usual” situations and that the circumstances of some individual patients may mean that different arrangements might pertain. This should be determined on a “case-by-case” basis.

<table>
<thead>
<tr>
<th>The following patients should be looked after primarily in primary care diabetes clinics</th>
<th>The following patients should be looked after primarily in secondary care diabetes clinics</th>
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<tbody>
<tr>
<td>• Newly-diagnosed patients with type 2 diabetes (subject to the criteria laid down in the glycaemia guidance).</td>
<td>• All Patients with type 1 diabetes (rapid onset, weight loss, or ketonuria).</td>
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<tr>
<td>• Patients with type 2 diabetes on diet alone.</td>
<td>• Children and young people (aged &lt; 12 years, 9 months to RHSC Yorkhill).</td>
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<td>• Patients with type 2 diabetes on oral anti-diabetic agents (see glycaemic control pathway).</td>
<td>• Any diabetic patient who is pregnant or is considering pregnancy.</td>
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<td>• Patients with type 2 diabetes who are stabilised on insulin therapy.</td>
<td>• Patients with secondary diabetes.</td>
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<td>• Patients who indicate a preference for primary care, where the practice agrees, unless there are reasons (as below) for secondary care attendance.</td>
<td>• Onset of diabetes at age &lt; 40 years.</td>
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<td>• Uncertain diagnosis or classification e.g. maturity onset diabetes in the young (MODY), secondary diabetes.</td>
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<td>• Foot ulceration or other serious foot problems (to foot clinic).</td>
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<td>• Patients started on insulin at the time of myocardial infarction.</td>
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<td>• Painful neuropathy/amyotrophy or other neurological complication not responding to simple treatment.</td>
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<td>• Diabetic nephropathy i.e. EMU protein:creatinine &gt; 45mg/mmol (patients with eGFR &lt;60 should be considered for direct referral to renal clinic as per Glasgow, Clyde &amp; Forth Valley eGFR/CKD leaflet).</td>
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<td>• Patients with recurrent severe hypoglycaemia.</td>
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</table>
Who should be referred to secondary care as an emergency for possible acute admission?

Where possible these patients should be discussed with the local diabetes centre/diabetes team as some of these patients may be managed as an outpatient and will not require an acute admission. (Clinic hours are between 8am-5pm, out with this refer via acute medical receiving).

- New onset type 1 diabetes (rapid onset, weight loss, ketonuria).
- A vomiting illness, especially if blood glucose is increasing, blood ketones and/or ketonuria is present.
- Any current illness if blood glucose is increasing despite increase in treatment, or ketonuria is present.
- Severe hypoglycaemia with seizures, continuing neurological or cognitive impairment.
- Critical ischaemia of legs (to vascular surgeons).
- Sudden loss of vision (to ophthalmology).

Who should be referred to secondary care for assessment?

- Patients with type 2 diabetes in whom there is doubt about whether they should receive insulin treatment following discussion between the diabetes specialist nurse and link consultant (see insulin initiation pathway).
- Patients encountering problems in diabetes management, especially if agreed metabolic targets are not being met.
- Patients with more than one episode of severe hypoglycaemia (i.e. requiring third party assistance).
- Uncontrolled blood pressure e.g. BP > 160 mmHg/100 mmHg on three or more hypotensive agents (see NHSGGC guideline).

Patients stabilised on oral hypoglycaemic agents or who have reverted to oral agents can usually be transferred back to primary care once investigations or treatment of complications has been completed. Some GP practices will be happy to resume care of patients suitably stabilised on insulin therapy.

DNA ARRANGEMENTS FOR YOUNG ADULT CLINICS

NHSGGC has a DNA policy. However, it is recognised that young adults with diabetes frequently default from clinic follow-up. This is a particularly vulnerable group who require continued monitoring and the MCN Transition Group have recommended specific arrangements for defaulters from young adult diabetes clinics. The recommendations are as follows;

RECURRENT DNAS

All centres should aim to send a reminder letter to patients 2 weeks before clinic visit. If patients DNA 2 consecutive appointments a letter should be sent to the GP and to the patient but still offer a further appointment. More than 2 DNAs are up to individual discretion as to how many appointments are offered.
If the patient is under 16 years and DNAd twice, Consultant and DSN should have phone contact with the GP and the patient or patient’s guardian. Contact with the relevant Social Work Department should be considered if a child under 16 fails to attend on several consecutive occasions.

**STRUCTURED EDUCATION FOR PATIENTS WITH DIABETES**

Structured patient education now has an evidence-based place in the management of people with both type 1 and type 2 diabetes. The diabetes MCN has agreed that all patients have access to a range of structured educational opportunities which will include both group and individual structured training. Service redesign will be required to achieve this. At present there is access for type 2 patients to DESMOND (diabetes education and self-management for ongoing and newly diagnosed) across the Board area.

Structured type 1 education provision is, at the time of writing, on a Board wide basis less equitable and under-developed. There is a DAFNE (dose adjustment for normal eating) subgroup of the Diabetes MCN. DAFNE is delivered at the New Victoria Infirmary, the Southern General and at Stobhill Hospital. Glasgow functions as a single DAFNE centre with central administration provided by the Long Term Conditions Unit. Gartnavel offers DICE (diabetes, insulin and carbohydrate education) administered and delivered at that site only. The Royal Alexandra Hospital in Paisley offers BUDDIE.

Structured education programmes should be quality assured and compatible with the Diabetes UK Educational Framework. All educational activity will be recorded and reviewed on a regular basis to ensure that access is universal. To this end, a specific educational co-ordinator should be appointed to oversee quality assurance and link to Diabetes Education Network Scotland.
MANAGEMENT OF TYPE 2 DIABETES

3 Month trial of lifestyle changes. Refer to DESMOND structured education programme. Set glycaemic target HbA1c < 7.0% (53mmol/mol) or individualised.

If HbA1c > 53mmol/mol (7%)

FIRST LINE ADD METFORMIN or Sulfonylurea if intolerant of metformin

If HbA1c > 53mmol/mol (7%)

SECOND LINE OPTIONS

- ADD SULFONYLUREA
  + COST EFFECTIVE
  - Consider alternatives options where hypo-glycaemia or weight gain are a concern (see table A).

- ADD GLITAZONE
  + Useful treatment for patients with fatty liver and NASH
  - WEIGHT GAIN & COST
    Fluid retention and increased risk of cardiac failure.
    Increased risk of fracture in post-menopausal women (see table A)
    Possible increased risk of bladder cancer
    Withdraw treatment after 6 months if HbA1c has decreased by < 0.5% (5.5 mmol/mol).

If HbA1c > 59 mmol/mol (7.5%)

THIRD LINE OPTIONS

- ADD GLIPTIN
  + Utility only if major reservations re metformin, sulfonylureas or pioglitazone
  - COST
    Weight neutral
    Withdraw treatment after 6 months if HbA1c has decreased by < 0.5% (5.5 mmol/mol).

- ADD GLP-1 analogue
  If BMI >30kg/m² and weight loss desirable (see table A)
  When hypoglycaemia is a concern (see table A)
  Maximum dose of liraglutide =1.2mg
  Treatment target is HbA1c reduction of 11mmol/mol AND weight loss of 3% of initial body weight

- ADD INSULIN
  If HbA1c is > 9.0% (75mmol/mol) oral agents will not fully correct.
  Use insulin when there is clear progression of the disorder.
  Review regularly at 6 months; if both targets not achieved withdraw GLP-1 treatment.

If HbA1c > 59 mmol/mol (7.5%) change to insulin +/- metformin

- ORAL ADMINISTRATION
  ADD GLITAZONE
    When subcutaneous agent is not acceptable (see table A).
    Weigh up positive and negative factors as for 2nd line treatment.
  ADD GLIPTIN
    When subcutaneous agent is not acceptable (see table A).
    Weigh up positive and negative factors as for 2nd line treatment.
  ADD GLP-1 analogue
    If BMI >30kg/m² and weight loss desirable (see table A)
    When hypoglycaemia is a concern (see table A)
    Maximum dose of liraglutide =1.2mg
    Treatment target is HbA1c reduction of 11mmol/mol AND weight loss of 3% of initial body weight

- SUBCUTANEOUS ADMINISTRATION
  ADD INSULIN
    If HbA1c is > 9.0% (75mmol/mol) oral agents will not fully correct.
    Use insulin when there is clear progression of the disorder.
    Review regularly at 6 months; if both targets not achieved withdraw GLP-1 treatment.
  ADD GLP-1 analogue
    If BMI >30kg/m² and weight loss desirable (see table A)
    When hypoglycaemia is a concern (see table A)
    Maximum dose of liraglutide =1.2mg
    Treatment target is HbA1c reduction of 11mmol/mol AND weight loss of 3% of initial body weight

If HbA1c > 59 mmol/mol (7.5%) consider insulin therapy

+ Means advantageous
- Means disadvantageous
Table A

<table>
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<th>Special Considerations</th>
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<th>Drug(s) to be used with caution</th>
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<td>Metformin</td>
<td>Sulfonylureas</td>
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<td>Living alone (especially elderly)</td>
<td>Pioglitazone</td>
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<td>Gliptins</td>
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<td>GLP-1 analogues</td>
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<td>Weight gain</td>
<td>BMI&gt;30 in Caucasians</td>
<td>Metformin</td>
<td>Sulfonylureas</td>
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<td>BMI&gt;28 in South Asians</td>
<td>Gliptins</td>
<td>Glitazones</td>
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<td>Obstructive sleep apnoea</td>
<td>GLP-1 analogues</td>
<td>Insulin</td>
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<td>Subcutaneous administration unacceptable</td>
<td>Needle phobia</td>
<td>Metformin</td>
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<td>Frail or elderly leading to loss of independence</td>
<td>Gliptins</td>
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<td>GLP-1 analogues</td>
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<td>Pioglitazone</td>
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<td>Risk of bone fractures</td>
<td>Postmenopausal females, known osteoporosis, alcoholism, hypothyroidism</td>
<td>Metformin</td>
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<td>Sulfonylureas</td>
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<td>GLP-1 analogues</td>
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<td>Risk of bladder cancer</td>
<td>Known bladder cancer, undiagnosed macroscopic haematuria</td>
<td>Metformin</td>
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<td>GLP-1 analogue</td>
<td></td>
</tr>
</tbody>
</table>

OPTIONS FOR FIRST LINE THERAPY

**Monotherapy**

Following the diagnosis and introduction of lifestyle changes, if HbA1C > 53mmol/mol (7.0%) consider starting an oral hypoglycaemic agent. Lifestyle changes should be encouraged and continued throughout all the stages of management of type 2 diabetes. Patients should receive initial advice from a state registered dietician. Those not responding to dietary advice and who meet the criteria should be considered for referral to the Glasgow Weight Management Program (see appendix 10).

**Metformin is first line therapy in combination with lifestyle changes**

Commence 500mg in the morning for first week and titrate upwards 500mg twice daily for a further week then 500mg three times daily. The dose may be further increased to a usual maximum of 2g daily, though specialists have used up to 3g daily. See BNF for contra-indications to metformin.

Metformin is contra-indicated in renal impairment, serum creatinine > 130 micro mol/l, (eGFR <30mls/min) and severe liver disease. There is an increased risk of lactic acidosis in renal impairment although the incidence of lactic acidosis attributable to metformin is very rare. NICE recommends reviewing the dose of metformin if eGFR less than 45ml/minute and to avoid if eGFR is less than 30ml/minute..

If HbA1c remains at or below 53mmol/mol (7.0%) continue to review the patient 6 monthly. Metformin has clinically relevant cardiovascular outcomes.

**Sulfonylurea (SU) 1st line therapy if metformin not tolerated or contra-indicated.**

---

Commence Gliclazide at 40 to 80 mg with breakfast. The dose can be further increased to 160 mg with breakfast or in divided doses. The maximum dose is 320mg daily in divided doses, the last dose usually with the early evening meal.

Gliclazide is the formulary preferred list SU. Glipizide and Glibenclamide are in the total formulary. However Glibenclamide a long acting SU is not used in the elderly because of a higher incidence of hypoglycaemia.

OPTIONS FOR SECOND LINE THERAPY

**Dual Therapy**

If adequate glycaemic control is not maintained on one agent (HbA1c > 53mmol/mol (7.0%) then dual therapy is necessary. The addition of a sulfonylurea or a glitazone to metformin therapy should be considered. The preferred agent will depend upon the individual patient and the relative indications and contra-indications for sulfonylureas, glitazones and gliptins. Gliptins should not be considered as second line therapy unless there are major reservations with the prescription of metformin, sulfonylureas or pioglitazone.

**Note that the addition of a second oral agent (sulfonylurea, pioglitazone or gliptin) is likely to improve HbA1c by no more than 9.0 – 16mmol/mol (0.8 – 1.5%).**

Refer to the BNF for a full list of cautions and contraindications.

**Sulfonylureas** augment insulin secretion and consequently are effective only when some residual pancreatic beta-cell activity is present. The major side-effects are hypoglycaemia and weight gain. The incidence of hypoglycaemia reported in a population study was 1%. Sulfonylureas are contra-indicated in severe hepatic and renal impairment. Sulfonylureas have no proven benefit on cardiovascular outcomes. Sulfonylureas are a cost effective treatment option.

**Glitazones**

Pioglitazone is the only drug of this class now available. It is associated with fluid retention and has precipitated heart failure and pulmonary oedema in patients at risk. It is contra-indicated in heart failure (NYHA class 1 to IV) or left ventricular dysfunction and should be avoided in hepatic impairment.

Subgroup analysis of the PROACTIVE study has shown that pioglitazone significantly reduces the risk of recurrent stroke and recurrent MI in high risk patients.

Pioglitazone is associated with an increased risk of upper limb fractures. The European Medicines Agency has recently issued recommendations for pioglitazone in order to reduce a possible, small increased risk of bladder cancer. Prescribers should not use pioglitazone in patients with current or a history of bladder cancer or in patients with uninvestigated macroscopic haematuria. Risk factors for bladder cancer should be assessed before initiating this therapy. The use of this medication in the elderly who have increased risk of bladder cancer, should be carefully considered.
Pioglitazone should be started at a dose of 15mg daily. Its maximum effect will take 4 – 6 weeks and the dose should not be increased until after this interval. The dose can be increased to 30mg and if necessary to 45mg once daily. Check LFTs before use and periodically thereafter. At present all suspected adverse reactions should be reported by the yellow card scheme to the Commission on Human Medicines.

**Gliptins**

GLIPTINS SHOULD NOT BE CONSIDERED AS SECOND LINE THERAPY UNLESS THERE ARE MAJOR RESERVATIONS WITH THE PRESCRIPTION OF METFORMIN, SULFONYLUREAS OR PIOGLITAZONE.

Gliptins are orally active inhibitors of dipeptidylpeptidase-4 resulting in increased levels of GLP1. There are no long term data on cardiovascular outcomes for this group of medications. Their advantages are that they are likely to be weight neutral and unlikely to cause hypoglycaemia. Restricted to specialist initiation for patients on metformin only when the addition of sulfonylureas or pioglitazone is not appropriate. **Only continue treatment after 6 months if HbA1c has decreased by 5.5 mmol/mol (0.5%). If this reduction is not achieved then the gliptin should be stopped.**

Sitagliptin is a once daily preparation while vildagliptin is a twice daily preparation. Vildagliptin requires 3 monthly monitoring of liver function during the first year and periodically thereafter. Linagliptin is a once daily preparation and can be used in moderate to severe renal impairment without change to normal dose. Saxagliptin is also once daily and has a licence for use at half normal dosage in moderate to severe renal impairment. Saxagliptin is currently the cheapest of this class. Refer to BNF for all cautions in renal and hepatic impairment. At present all suspected adverse reactions should be reported by the yellow card scheme to the Commission on Human Medicines.

**OPTIONS FOR THIRD LINE THERAPY**

**Triple Therapy**

If HbA1c is > 59 mmol/mol (7.5%) on two oral hypoglycaemic agents then the addition of a third agent can be considered. If patients are on metformin plus sulfonylurea then consider adding glitazone. Similarly a sulfonylurea can be added to the combination of metformin plus glitazone. Alternatively, a gliptin could be introduced as a third agent. Oral agents and GLP-1 analogues are unlikely to reduce HbA1c levels by more than 9.0 – 16mmol/mol (0.8 – 1.5%) although the higher the initial level of HbA1c the greater is the subsequent drop with treatment. If HbA1c is therefore above 75mmol./mol (9%) on two agents do not consider triple therapy and move directly to insulin treatment.

**GLP-1 Analogues**

Exenatide and Liraglutide are glucagon like peptide 1 (GLP1) analogues which increases insulin secretion, delay gastric emptying and suppresses glucagon secretion. Treatment with a GLP1 is associated with the
prevention of weight gain and possible promotion of weight loss. They are available as subcutaneous injections. There is no outcome data for this class of drugs.

GLP-1 analogues should only be considered in patients with a BMI >30Kg/m².

GLP-1 analogues should be used initially over a 6 month trial period. The treatment should be continued after this period only if targets are achieved. These would be a reduction in HbA1c of at least 11mmol/mol (1%) and weight loss of 3% or more of initial body weight. Treatment must be reviewed every 6 months and if efficacy is waning treatment should be changed to insulin therapy.

**Restricted to specialist initiation as an alternative to insulin in patients who have failed treatment on (metformin and sulfonylureas) dual therapy and in whom insulin would be the next treatment option.**

At present all suspected adverse reactions should be reported by the yellow card scheme to the Commission on Human Medicines.

**The Introduction of Insulin**

If there is suboptimal control with two (or three) oral hypoglycaemic agents or if dual therapy is contraindicated then insulin should be introduced with one oral hypoglycaemic agent, preferably metformin.

**Acarbose**

Acarbose is less effective than other oral hypoglycaemic agents but may be prescribed by specialists in addition to other agents for patients intolerant of metformin.

**Nateglinide and Repaglinide**

These drugs are not on the GGC Formulary. Any exceptional use of these medicines should be subject to GGC non-Formulary processes.
INSULIN THERAPY IN TYPE 2 DIABETES

The most common indication for insulin in these patients is worsening glycaemic control on oral agents. The decision to switch treatment to insulin can be difficult and the following factors should be taken into account:

- Age;
- Other health problems, e.g. complications such as visual loss;
- Social circumstances, e.g. patients holding LGV/PSV licence;
- Patient’s attitude;
- Dietary assessment by a dietician prior to converting to insulin;
- Patient’s weight.

In general, obese patients who are not losing weight despite hyperglycaemia do not fare better on insulin.

A frequent problem encountered in treating those with type 2 diabetes, is the inevitable gain in weight after starting insulin. On average, this is around 4 kg after 6 months. Patients should be warned that this might occur particularly if they fail to reduce energy intake. Patients should be referred to dietician to discuss diet in view of weight problem.
## INSULIN TREATMENT OPTIONS FOR CONVERSION FROM DIET AND ORAL HYPOGLYCAEMICS TO INSULIN

Option A or Option B are the regimes that patients are commonly commenced on.

<table>
<thead>
<tr>
<th>Option A</th>
<th>Option B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BASAL INSULIN REGIMEN</strong>&lt;br&gt;ONCE DAILY INJECTION</td>
<td><strong>MIX REGIMEN</strong>&lt;br&gt;TWICE DAILY INJECTIONS</td>
</tr>
<tr>
<td>NPH Insulin initially (preferably at bedtime). If hypos a concern use a basal analogue insulin (Type 1 patients only).</td>
<td>Mixture of&lt;br&gt;Soluble + NPH&lt;br&gt;Or&lt;br&gt;Analogue + NPH (Type 1 patients only)&lt;br&gt;Before breakfast and before tea</td>
</tr>
<tr>
<td>Advantages:</td>
<td>Advantages:</td>
</tr>
<tr>
<td>• Convenient, easy for carers and nurses</td>
<td>• Easy to adjust</td>
</tr>
<tr>
<td>• Only one injection</td>
<td></td>
</tr>
<tr>
<td>• Insulin can be adjusted on basis of fasting glucose results only</td>
<td>Disadvantages:</td>
</tr>
<tr>
<td></td>
<td>• Less optimal control</td>
</tr>
<tr>
<td></td>
<td>• Inflexibility</td>
</tr>
<tr>
<td></td>
<td>• Requires more frequent blood glucose monitoring</td>
</tr>
<tr>
<td></td>
<td>• Less convenient if dependent upon carers to give insulin</td>
</tr>
<tr>
<td>Disadvantages:</td>
<td></td>
</tr>
<tr>
<td>• Less optimal control</td>
<td></td>
</tr>
<tr>
<td>• Possibility of continuing OHA</td>
<td></td>
</tr>
<tr>
<td>• Possibility of hypos</td>
<td></td>
</tr>
</tbody>
</table>

The following regimes may be considered if there is a need for more control or more flexibility.

<table>
<thead>
<tr>
<th>Option C</th>
<th>Option D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>THREE INJECTIONS DAILY</strong></td>
<td><strong>BASAL PLUS BOLUS</strong>&lt;br&gt;MULTIPLE INJECTIONS</td>
</tr>
<tr>
<td>1. Mixture of Soluble &amp; NPH before breakfast</td>
<td>Soluble before breakfast and/or lunch and/or tea (bolus) and either</td>
</tr>
<tr>
<td>2. Soluble or Analogue before tea</td>
<td>(a) NPH at supper time or (b) Long acting Analogue at same chosen time each day for Type 1 patients only (basal)</td>
</tr>
<tr>
<td>3. NPH before supper or long acting analogue at same chosen time each day</td>
<td></td>
</tr>
<tr>
<td>Advantages:</td>
<td>Advantages:</td>
</tr>
<tr>
<td>• Improves control</td>
<td>• Optimal Control</td>
</tr>
<tr>
<td>• More flexible</td>
<td>• Optimal Flexibility</td>
</tr>
<tr>
<td>Disadvantages:</td>
<td>Disadvantages:</td>
</tr>
<tr>
<td>• 3 injections</td>
<td>• Up to 4 injections</td>
</tr>
<tr>
<td>• Compliance may compromised</td>
<td>• More blood testing required</td>
</tr>
</tbody>
</table>

**KEY:**<br>Long acting analogue insulin = Glargine, Detemir<br>Analogue Insulin = Insulin Aspart / Insulin Lispro / Insulin Glulisine<br>Soluble Insulin = Actrapid<br>Isophane Insulin = Insulatard<br>MIX = Humulin M3, HUMALOG Mix 25, NOVOMIX 30
ALL NEW PATIENTS SHOULD BE STARTED ON HUMAN INSULINS. There is no evidence for improved diabetes control with analogue insulins in patients with type 2 diabetes. Human insulatard is recommended for use as a background insulin. Insulin Glargine or insulin Detemir should only be considered in patients with type 2 diabetes who are troubled by night time hypoglycaemia. Consideration should be made to change to Human Insulatard, patients already on analogue insulins where there is no specific indication.

Conversion to Insulin Detemir

Switching from Isophane to Glargine or Detemir + Oral Hypoglycaemic Agents

Dose for dose transfer

Switching from Isophane to Glargine or Detemir - basal bolus regimen

<table>
<thead>
<tr>
<th>Previous basal frequency</th>
<th>Suggested once daily Detemir dosing (evening)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once daily Isophane</td>
<td>Dose to dose transfer</td>
</tr>
<tr>
<td>Twice daily Isophane</td>
<td>Reduce dose by 30%</td>
</tr>
</tbody>
</table>

COMMONLY USED INSULIN PREPARATIONS

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SOURCE</th>
<th>ONSET</th>
<th>DURATION ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin lispro</td>
<td>Analogue</td>
<td>A</td>
<td>0-5 min</td>
<td>3 hours</td>
</tr>
<tr>
<td>Insulin aspart</td>
<td>Analogue</td>
<td>A</td>
<td>10-20 min</td>
<td>3-5 hours</td>
</tr>
<tr>
<td>Insulin glulisine</td>
<td>Analogue</td>
<td>A</td>
<td>12-30 mins</td>
<td>3-4 hours</td>
</tr>
<tr>
<td>Actrapid</td>
<td>Soluble</td>
<td>H</td>
<td>30 mins</td>
<td>7-8 hours</td>
</tr>
<tr>
<td>Humulin-S</td>
<td>Soluble</td>
<td>H</td>
<td></td>
<td>6-8 hours</td>
</tr>
<tr>
<td>Hypurin Neutral</td>
<td>Soluble</td>
<td>B,P</td>
<td></td>
<td>30-60 min</td>
</tr>
<tr>
<td>Insulan Rapid</td>
<td>Soluble</td>
<td>H</td>
<td>30 mins</td>
<td>7-9 hours</td>
</tr>
<tr>
<td>Insulatard</td>
<td>NPH</td>
<td>H</td>
<td>90 mins</td>
<td>24 hours</td>
</tr>
<tr>
<td>Humulin-I</td>
<td>NPH</td>
<td>H</td>
<td>1-2 hrs</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Hypurin Isophane</td>
<td>NPH</td>
<td>B,P</td>
<td></td>
<td>8-12 hrs or longer</td>
</tr>
<tr>
<td>Insulan Basal</td>
<td>NPH</td>
<td>H</td>
<td>1 hour</td>
<td>11– 20 hours</td>
</tr>
<tr>
<td>Insulin Detemir at &gt;0.5u/kg hrs</td>
<td>Analogue</td>
<td>A</td>
<td>3-4 hrs</td>
<td>20-24 hrs</td>
</tr>
<tr>
<td>Insulin Glargine</td>
<td>Analogue</td>
<td>A</td>
<td></td>
<td>24 hrs</td>
</tr>
<tr>
<td>Hypurin PZI</td>
<td>Protamine Zinc Insulin</td>
<td>B</td>
<td></td>
<td>24 hrs</td>
</tr>
<tr>
<td>Hypurin Lente</td>
<td>Insulin Zinc Susp</td>
<td>B</td>
<td></td>
<td>24 hrs +</td>
</tr>
</tbody>
</table>
Examples of fixed mixtures

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SOURCE</th>
<th>ONSET</th>
<th>DURATION OF ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NovoMix 30</td>
<td>Biphasic</td>
<td>A</td>
<td>0-5 min</td>
<td>up to 24 hours</td>
</tr>
<tr>
<td>Humalog Mix 25</td>
<td>Biphasic</td>
<td>A</td>
<td>0-5 min</td>
<td>up to 15 hours</td>
</tr>
<tr>
<td>Humulin M3</td>
<td>Biphasic</td>
<td>H</td>
<td>30-60 mins</td>
<td>8-12 hrs +</td>
</tr>
<tr>
<td>Hypurin 30/70</td>
<td>Porcine</td>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insuman Comb 25</td>
<td>Biphasic</td>
<td>H</td>
<td>30-60 mins</td>
<td>12-19 hours</td>
</tr>
</tbody>
</table>

SOURCE:  A = Analogue H = Human P = Porcine B = Bovine

Please note: If changing patients from porcine or bovine insulin to human insulin, initially start on a reduced dose of insulin and encourage more frequent blood glucose monitoring. Hypoglycaemia can be more common and the symptoms may differ.

For all patients starting insulin, please contact a diabetes nurse specialist.

- When prescribing insulin please specify the type and dose on both the drug kardex and insulin prescription chart.

INSULIN REGIMENS AND DOSAGE ADJUSTMENT

Principles of Dosage Adjustment

- No one set of advice can cope with all situations.
- Never change insulin on the basis of one off readings.
- Always check monitoring technique/injection technique.
- Identify the periods of day in which the greatest problems are occurring and look for a pattern in readings.
- Are monitoring values credible?
- Review insulin dose distribution.
- Review diet:
  - Are they having regular meals/snacks at times to suit the profile of their insulin regimen?
  - Do all meals/snack contain complex carbohydrate?
  - Does the diet include foods/drinks with a high sugar content?
  - What is their alcohol consumption?
  - What is their physical activity pattern?
  - DAFNE trained patients should have a review of the DAFNE rules.
  - Refer to a dietitian if required.
- Review whether poor control in one period of the day is not a hangover from a previous period.
- Agree an adjustment of dose by 2 units initially.
- Most patients are capable at becoming skilled at self-adjustment of their regime.
Twice Daily Regimen

Insulin is administered as two injections before meals, usually before breakfast and before evening meal. This is most commonly distributed as a one third:two thirds mixture of soluble and isophane insulin or given as a fixed biphasic insulin e.g. Humulin M3. Premixed formulations of a rapid acting and intermediate acting insulin analogue are also available (e.g. Humalog Mix 25/Novomix 30) which are also suitable for twice daily administration.

To adjust insulin doses on a ‘free-mixing’ regime.

- If glucose high/low before breakfast, increase/decrease EVENING long acting insulin.
- If glucose high/low before lunch, increase/decrease MORNING short acting insulin.
- If glucose high/low before tea, increase/decrease MORNING long acting insulin.
- If glucose high/low before bed, increase/decrease EVENING short acting insulin.

To adjust insulin doses for a fixed (biphasic) insulin mixture.

- If glucose high/low before breakfast, increase/decrease EVENING insulin dose.
- If glucose high/low before tea, increase/decrease MORNING insulin dose.
- It may be necessary to alter the distribution of carbohydrate between meals and snacks.

Basal + Bolus Regimens

This consists of an injection of a basal insulin in the form of isophane or long acting analogue along with a soluble or rapid-acting insulin analogue before the main meal of the day. (Analogue insulins have no proven benefit for patients with type 2 diabetes). If this fails to produce adequate control of hyperglycaemia, additional insulin boluses can be added at other mealtimes. Isophane insulin is recommended on the basis of cost. However, if patients are experiencing hypoglycaemic episodes (particularly nocturnal hypos) replacement with insulin glargine or insulin Detemir should be considered.

Although this regimen consists of multiple injections, it does not necessarily give better blood glucose control, on average, than twice-daily regimens.

The main advantage of this regimen is improved flexibility, especially in coordinating insulin doses with meal size and physical exercise. It is therefore most suited to young patients and those on shift work. For dosage adjustment with basal bolus regimen:

- If glucose high/low before breakfast, increase/decrease EVENING long acting insulin;
- If glucose high/low before lunch, increase/decrease MORNING short acting insulin;
- If glucose high/low before tea, increase/decrease LUNCHTIME short acting insulin;
- If glucose high/low before bed, increase/decrease TEATIME short acting insulin.

In the event of an individual patient’s insulin regimen being changed, the patient should be referred to a dietitian. Some patients changing to a basal bolus regimen may require advice from a dietitian on carbohydrate counting.
Rapid Acting Insulin Analogues

- Rapid-acting analogues of insulin (e.g. insulin Lispro, Insulin Aspart, insulin Glulisine) may be used in both twice daily and basal bolus regimens.
- For some patients on rapid acting insulin analogues, monitoring of post-prandial (2 hours) glucose may be required to assist with dosage adjustment.

Over Insulinisation

The following symptoms are suggestive of over insulinisation:

- Recurrent hypos;
- Wildly swinging glucose values;
- Weight gain;
- Subtle features of chronic hypo – headache;
- Need to eat;
- Personality change in elderly.

Under Insulinisation

The following symptoms are suggestive of too little insulin:

- Chronic hyperglycaemia/osmotic symptoms;
- Weight loss;
- Generally unwell;
- Nocturnal osmotic symptoms (thirst, nocturia).

Insulin in the Elderly (see Diabetes and the Elderly)

Age itself is not a contraindication to insulin therapy.

- Targets for glycaemic control in the elderly need not be as stringent as in the younger patient.
- The aims of treatment are to control hyperglycaemia with particular avoidance of hypoglycaemia.

It may be best to avoid soluble insulin in the very elderly. Regimens using twice daily isophane or peakless basal insulin are often best in this age group.
# GUIDELINES FOR THE SELF MONITORING OF BLOOD GLUCOSE

This is a guideline for what is minimally acceptable clinically. If a patient, no matter the treatment group, wishes to monitor more frequently they should be supported to do so (within reason).

<table>
<thead>
<tr>
<th>Diabetes type</th>
<th>Treatment group</th>
<th>Monitoring regime</th>
</tr>
</thead>
</table>
| Type 1 diabetes | All people with Type 1 diabetes | Blood glucose monitoring should be seen as an integral part of treating Type 1 diabetes and patients should be trained appropriately.  
- Monitor blood glucose 4 or more times per day.  
- More frequent testing will be required in the following circumstances: myocardial infarction, dialysis, pregnancy, illness (see sick-day rules), persistent hyperglycaemia, impaired awareness of hypoglycaemia, driving long distances and those on insulin pumps.  
Speak to your Diabetes Specialist Nurse / Practice Nurse if unsure.  
- Carers / Health professionals delivering insulin should test blood glucose prior to administration. |
| Pregnancy Type 1, Type 2 and Gestational Diabetes (GDM) |  
- For women treated with diet alone 3 pre-meal and 1 post-prandial blood glucose test per day.  
- Women with Type 2 diabetes on oral hypoglycaemic agents and planning a pregnancy should be commenced upon insulin therapy and have good control prior to conception. Monitor therefore as per Type 1 before and after conception.  
- GDM patients on insulin should monitor as per Type 1. |
| Type 2 diabetes Insulin therapy |  
- Once a day basal bolus  
- Twice a day plus other therapies.  
- More than Twice a day.  
- Once a day if not experiencing hypoglycaemia.  
- Twice/day at various times to include pre and postprandial and pre bedtime.  
- As Type 1. |
| Type 2 diabetes Sulfonylurea (alone or in combination with other oral antidiabetic agents) | Regular testing is not necessary in normal circumstances. On an individual patient basis testing may be appropriate e.g. as an educational tool, recurrent illness, to ensure safe driving. Where hypoglycaemia is a common occurrence blood glucose should be monitored four times/day for 1 week and then advice sought from a practice nurse or diabetes specialist nurse if the situation not resolved. |
| Type 2 diabetes Incretin Mimetic (Exenatide or Liraglutide) and Gliptins | As Sulfonylureas |
| Type 2 diabetes Diet and exercise | HbA1c is the real outcome measure in these people. Blood glucose monitoring should not be required routinely. |
| Type 2 diabetes Metformin (+/- glitazone) | As per diet and exercise. |
| Type 2 diabetes Glitazone (+/- metformin) | As per diet and exercise. |
INTRODUCTION

The National Institute for Clinical Excellence (NICE) reviewed the evidence on continuous subcutaneous insulin infusion (CSII or insulin pump therapy) and found that it improved quality of life for a small sub-group of people (1–2%) who could not achieve glycaemic control with multiple dose insulin therapy. (NICE Technology Appraisal Guidance No.57).

CLINICAL LEADERSHIP

Currently insulin pump therapy for adults is not of high priority in GGC. At present funding is available for only 6 adult patients per year.

Supervising consultants at pump sites will be responsible for:

- Overseeing the appropriate clinical assessment including detailed assessment by diabetes specialist nurse responsible for CSII therapy in Greater Glasgow & Clyde. The DSN will provide appropriate education in the use of the pump;

- CSII Consultant leads will make the decision whether a pump is clinically indicated and whether the patient has the commitment and competence to manage use of a pump (with aid of MCN Lead Clinician if required).

The Lead Consultants will be notified when a patient commences insulin pump therapy and will be clinically responsible for that patient during the implementation period of treatment. In accordance with NICE guidelines, insulin pump therapy will be initiated by a trained team comprising of a Physician with a specialist interest in pump therapy, a Diabetes Specialist Nurse and Dietitian. Pump users attending Gartnavel General Hospital for insulin pump initiation will attend Gartnavel General Hospital after stabilisation for continuing diabetes care. Pump users attending RAH for insulin pump initiation will be returned to their referring hospital after stabilisation for continuing diabetes care. The CSII Diabetes Specialist Nurse will review their pump therapy on an annual basis or if referred by diabetes team.

REFERRAL CRITERIA


- Repeated and unpredictable occurrence of hypoglycaemia with continuing anxiety about recurrence.
• On multiple-dose insulin (MDI) therapy (including, where appropriate, the use of insulin glargine) which has failed. Patients are expected to have undergone training on carbohydrate counting/insulin adjustment via DNS/dietetic input before failing on MDI.

• People for whom MDI therapy has failed are considered to be those for whom it has been impossible to maintain HbA1c level no greater than 7.5% (58mmol/mol) without significant hypoglycaemia.

• Recommendations are applicable to children, adolescents, pre-pregnant and pregnant women for whom MDI is deemed to have failed.

NEW REFERRALS FOR PUMP THERAPY

Currently the priority for pump therapy in GGC is paediatric patients.

TRANSITION ARRANGEMENTS FOR PATIENTS ALREADY ON PUMP THERAPY

• A pump user transferring from a UK Health Board (funded) to Greater Glasgow & Clyde Health Board will be invited to attend the pump clinic where they will be assessed. Due to funding constraints they may require to be added to the waiting list or they may wish to self-fund.

• A pump user transferring from a UK Health Board to Greater Glasgow & Clyde Health Board (self-funding) will be invited to attend the pump clinic where they will be assessed. The patient will continue to self-fund.

• A pump user transferring from outside the UK (self-funding) to Greater Glasgow & Clyde Health Board will be invited to attend the pump user clinic for assessment. The patient will continue to self-fund.

• A pump user transferring to Greater Glasgow & Clyde Health Board with a postal address out with Greater Glasgow & Clyde, the Health Board within the pump user’s postal address will be requested to fund if patient fulfils NICE criteria.

If a patient requires further assessment the MCN Clinical Lead for Greater Glasgow & Clyde (currently Dr A Gallagher) will be asked to re-assess the patient.

PUMPS AVAILABLE

It is proposed that Greater Glasgow & Clyde will supply the Medtronic Paradigm real time pump. The supplier and pump availability will be reviewed on a yearly basis, at this time other pump companies may be asked to supply Greater Glasgow & Clyde. All pump users who are self-funding and where the pump is from another supplier the patient will be supported in their diabetes care.

PATIENT EDUCATION AND SUPPORT

Patients going onto pump therapy require intensive education and support to use them effectively. Initial education, on-going support and lifestyle advice will be provided by the DSN for insulin pump services. There will be a structured education and review process for months one, two of the therapy, with the expectation that from month three, the patient will self-manage their diabetes with support as they require.
On-going CSII training and education will be delivered for HCP within Greater Glasgow & Clyde from May 2008.

**MONITORING AND EVALUATION**

A database of patients receiving pump therapy will be established. The database will be held by the DSN for insulin pump service and/or MCN Manager.

The database will include both adults and children within Greater Glasgow & Clyde. Yorkhill Hospital for Sick Children will hold the database for Glasgow’s paediatric pump users.

This will allow monitoring of how many people receive pumps, criteria used to guide the decision to use pumps and clinical benefits through audit.

Patients will be asked to commit to a structured training and education programme, attend clinic appointments as before but also attend the nurse led clinic if necessary for further education and support. Patient’s commencing insulin pump therapy will be invited to sign an agreement prior to commencement of insulin pump therapy.
Ramadan is the ninth month of the Islamic calendar, a time when Muslims across the world fast during the hours of daylight. Islam uses a lunar calendar. Lunar months are shorter than solar months and therefore the start of Ramadan is about 11 days earlier each year in the Western calendar.

Muslims can eat and drink as long as the sun has set. It is common to have one meal (known as suhur or sehri) just before sunrise and another (known as iftar) directly after sunset. The taking of medications including eye drops, ear drops and intravenous fluids is forbidden during the daylight hours. There are a number of exemptions however. These include acutely ill people and those suffering from severe chronic conditions including diabetes.

Safe fasting and feasting is usually possible for the majority of people with type 2 diabetes if they follow medical advice. However, there are a number of diabetic patients who should be advised not to fast:

- Patients with poor glycaemic control (HbA1c >12%)
- Patients known to be non-compliant with advice on diet and drug regimens
- Patients with unstable angina
- Patients with a degree of alertness problems
- Patients who have had several episodes of hypoglycaemia or are at increased risk of hypoglycaemic attacks
- Patients who are pregnant
- Patients with unstable/deteriorating CKD or renal stones

These patients can find it difficult for social and religious reasons not to fast. It is therefore important that you:

1) Reassure them that they are not contravening the Islamic Law as they are exempt because of health reasons
2) Highlight that the maintenance of good health is imperative in Islam even during Ramadan.
3) Inform them that religious leaders have strongly advised that those with health conditions seek professional advice and comply with this before fasting
4) Remind them that the chronically ill may substitute fasting by providing food each day for the “poor”. An act of generosity instead of fasting is called fidya.
5) Eye/ear drops and injections are not considered breaking a fast by the majority verdict of Islamic jurists.

Meal Planning

The length of fasting will depend on when Ramadan falls in the year. For example, during the summer months when daylight is longer the fast will be longer. This will have an impact on meals.
- The morning meal will be very early and therefore may not consist of the usual type of breakfast the individual is used to.
• The evening meal may be more heavy than usual and have a much greater calorific content.

Patients on oral hypoglycaemics

Once daily preparations may be easier for the patient to manage and should be taken at the end of the fast, when the main meal is taken. Oral agents which are less likely to cause hypoglycaemia may be preferred (metformin, glitazones and gliptins).

Patients on insulin

The type of insulin or the number of units taken at meal times may need to be changed. It is therefore important that such patients discuss their management with dietitians, GPs and/or diabetes specialist nurses. Advise patients to check blood glucose each day, before the start of fasting, as required during the day and 1 – 2 hours after breaking the fast.

The following web address is useful for clinicians wanting more information on Ramadan: http://library.nhsggc.org.uk/mediaAssets/My%20HSD/2011-05-31-RAMADAN_RESOURCE_PACK.pdf
MANAGEMENT OF ACUTE DIABETIC EMERGENCIES

Below is a standard regime outlining the management of diabetic ketoacidosis in adults. There is also a wall chart published by the Scottish Study Group. Specific guidelines exist for the management of DKA in children.

MANAGEMENT OF DIABETIC KETOACIDOSIS (DKA)

Diagnosis – severe uncontrolled diabetes with:

1. Hyperglycaemia (blood glucose > 14mmol/l, usually but not exclusively);
2. Metabolic Acidosis (H⁺ >45mEq/L or HCO₃⁻ <18 mmol/L or pH <7.3 on venous gases);

Consider medical HDU if available.

The new national protocol for the emergency management of DKA should be used for all eligible patients (for paediatric management go to www.bsped.org.uk). With the new national protocol the care pathways for 0 – 4 hours and 4 hours – discharge should be completed for each DKA episode. These provide instruction on fluid balance, insulin and potassium replacement.

The care pathways are available within relevant departments or online at:

Care pathway 0 – 4 hours;
http://www.diabetesinscotland.org.uk/Publications/DKA%20Care%20Pathway%201%20v10.pdf

Care pathway 4 hours – discharge

OTHER POINTS TO CONSIDER

1. Sensitivity to insulin can vary markedly with time and between patients.

2. Higher doses of insulin are needed in adolescents, patients taking >1U/kg in the basal state and patients on steroid therapy, with sepsis, obesity or liver disease.

3. Consider the precipitant: 1st presentation type 1 diabetes mellitus, sepsis, compliance with insulin therapy or other causes.

4. If blood glucose levels are not falling always check pump devices, IV lines and IV cannulae to ensure patients are getting prescribed insulin dose. Consider other causes that could be contributing: sepsis, steroid therapy, obesity or liver disease.
EDUCATION AND SUPPORT

When the clinical condition has stabilised, consider the educational and emotional needs of the patient and carers. All patients with DKA should be referred to the diabetes team. Known diabetes patients must be discussed with a member of the diabetes team at the earliest opportunity.
MANAGEMENT OF HYPEROSMOLAR NON KETOTIC COMA (HONC) / HYPERGLYCAEMIC HYPEROSMOLAR STATE

This occurs in elderly patients with type 2 diabetes mellitus (which may or may not have been previously diagnosed). There is marked hyperglycaemia and dehydration without significant ketosis and acidosis. The condition usually develops over a period of days, often made worse by diuretics and consumption of glucose rich drinks.

The aim should be for a gradual restoration of blood biochemistry avoiding a rapid reduction in plasma osmolality (which can precipitate cerebral oedema). These patients commonly have co-existing medical problems and mortality is much higher than for DKA. There is also a significant risk of thromboembolism and thromboprophylaxis should always be used in the absence of contra-indication.

DIAGNOSTIC CRITERIA

1. Severe hyperglycaemia (blood glucose > 30 mmol/l).
2. Total osmolality > 340mOsm/kg.
3. Serum bicarbonate >15mmol/l (not acidotic).
4. Urinary ketones < + plus.

CLINICAL FEATURES

1. Insidious onset.
2. Severe dehydration.
3. Impaired level of consciousness (degree correlates with plasma osmolality).
4. May have concurrent illness e.g. MI, stroke or pneumonia.

INVESTIGATIONS

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1.</td>
<td>Glucose</td>
<td>Often exceeds 40 mmol/l.</td>
</tr>
<tr>
<td>2.</td>
<td>U&amp;Es</td>
<td>Hypernatraemia and dehydrated.</td>
</tr>
<tr>
<td>3.</td>
<td>Venous blood gases</td>
<td>Relatively normal (not acidic as seen in DKA).</td>
</tr>
<tr>
<td>4.</td>
<td>Osmolality</td>
<td>Calculate by [2 x (Na + K) + urea + glucose]. Usually &gt;350 mosmol/kg.</td>
</tr>
<tr>
<td>5.</td>
<td>FBC</td>
<td>† Hb and † WBC are usually raised in severe dehydration and are not reliable markers of infection.</td>
</tr>
<tr>
<td>6.</td>
<td>ECG</td>
<td>May show ischaemia or infarction.</td>
</tr>
<tr>
<td>7.</td>
<td>CXR</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Urinalysis</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>MSSU/blood cultures</td>
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</tbody>
</table>
INITIAL MANAGEMENT

IV insulin and IV fluid replacement are the mainstays of treatment but both should be used more cautiously compared to DKA (see above).

1. Oxygen.
2. CVP monitoring often required to guide fluid replacement.
3. NG tube if reduced level of consciousness or protracted vomiting.
4. Urinary catheter.
5. Prophylactic heparin, if no contraindications.

IV FLUIDS

Give first litre over 1 hour, second litre over 2 hours, third litre over 4 hours, fourth litre over 6 hours and fifth litre over 8 hours. Faster rehydration than this is inappropriate in hyperosmolar coma. This is a guide and should be reviewed in the elderly/cardiac disease according to CVP, clinical assessment and co morbidity.

If the corrected sodium concentrations are high (>155mmol/l) after the initial 1-2 litres of 0.9% saline, then 0.45% saline should be considered after discussion with Consultant staff or the diabetes team. Serum electrolytes should be monitored closely.

When blood glucose level falls below 14mmol/L add in 10% glucose at a rate of 100ml/hr.

Review the patient closely to determine hydration status and consider the need for, and rate of rehydration with sodium chloride 0.9% solution.

IV INSULIN

A starting infusion rate similar to that for DKA can be used. Start at 6 units/hour of insulin. Aim for a target blood glucose of between 9 and 14mmol/L. Remember to aim for a gradual reduction in blood sugar in order to prevent sudden osmotic shifts. Aim for a fall in blood glucose at a rate of 2-3mmol/hour. It may be necessary to adjust the insulin infusion rate to achieve this. If the blood glucose fall is too rapid with 6 units/hour of insulin then consider reducing the rate to 3 units/hour. When blood glucose falls below 14 mmol/L add in 10% glucose 100 ml/hour. Be prepared to adjust insulin infusion rate to maintain blood glucose within the target range. If blood glucose levels not falling, always check pump devices, IV lines and IV cannulae to ensure patients are getting prescribed insulin dose. Consider other causes that could be contributing: sepsis, steroid therapy, obesity or liver disease. 
POTASSIUM MONITORING AND REPLACEMENT

The initial serum potassium can be normal or elevated but the potassium level may fall in response to the patient being treated with insulin. Essential to check Urea and electrolytes on admission, and at 2 hours and 4 hours, to guide appropriate potassium replacement. Aim for a serum potassium of 4 – 5 mmol/L. Potassium chloride can be added to IV fluids (unless patient anuric) to maintain potassium within this range.

<table>
<thead>
<tr>
<th>Serum Potassium (mmol/L)</th>
<th>Potassium chloride to be given (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;5</td>
<td>0</td>
</tr>
<tr>
<td>3.5 – 5</td>
<td>20</td>
</tr>
<tr>
<td>&lt; 3.5</td>
<td>40</td>
</tr>
</tbody>
</table>

(N.B. Potassium bags are available as 20mmol/500ml)

To give potassium chloride 20 mmol/L give one 500 ml bag of fluid containing potassium chloride 20 mmol and then run through a bag of 500 ml fluid not containing any potassium.

- The usual maximum rate of potassium administration is 10 mmol/hour. Faster rates can be given but ensure that ECG monitoring is done.

N.B. Do not administer potassium chloride at rates > 20 mmol/hour under any circumstances.

CONTINUED MANAGEMENT

6. Continue IV fluids and insulin until normal biochemistry is restored and patient is eating and drinking normally. This may take up to 48-72 hours.

7. Recommence insulin or oral hypoglycaemics in patients previously treated. Many patients who were previously undiagnosed can be managed on diet therapy alone, some will require oral hypoglycaemics.

8. Discuss with a member of the diabetes team pre discharge.

REFERENCES


MANAGEMENT OF HYPOGLYCAEMIA

All documented blood glucose values < 4.0 mmol/l can be considered a hypoglycaemic event and should not be tolerated in any patient on a regular basis.

The symptoms and signs can be variable and a high index of suspicion is often required. Glucostix can be inaccurate at low blood glucose concentrations and a laboratory sample should be sent for confirmation. This should not delay giving appropriate treatment.

By far the commonest cause is treatment with insulin or sulfonylurea drugs in patients known to have diabetes. This may be accidental or deliberate.

Remember that long acting insulins and oral hypoglycaemic drugs e.g. glibenclamide, may be associated with prolonged hypoglycaemia requiring IV glucose infusion (for 24 hours or more) and regular (at least hourly) blood glucose monitoring.

MANAGEMENT OF MILD HYPOGLYCAEMIA

Rapid acting carbohydrate e.g. sugary drink or jelly babies, followed by slower acting carbohydrate e.g. banana or sandwich. DAFNE trained patients have specific guidance here.

MANAGEMENT OF MODERATE/SEVERE HYPOGLYCAEMIA

- IV glucose is the treatment of choice. 50% dextrose is a venous irritant and should no longer be used.
- Alternatives are 125mls of 20% dextrose or 250mls of 10% dextrose. This is less likely to be irritant to veins.
- Glucogel is a thick glucose gel which is easily absorbed through the buccal mucosa. It is indicated in confused patients but should not be used when consciousness is impaired.
- Glucagon 1mg should be given IM. It takes around 10 minutes to act and relies on endogenous glycogen stores, it may therefore be less effective in starvation or chronic liver disease.

Patients may experience abdominal discomfort and vomiting after glucagon administration. Patients will often have a high glucose for several hours after a hypo due to the counter regulatory hormonal response and as a result of the exogenous glucose administration.

FOLLOWING A HYPOGLYCAEMIC EPISODE

- Investigate the likely cause e.g. missed meal, dosage error, increased exercise, alcohol excess, deliberate overdose.
- Establish the presence of hypoglycaemic ‘warning symptoms’ i.e. sweating, tremor, tachycardia. These may be impaired in patients with longstanding diabetes.
- Review educational and emotional support needs before discharge (liaise with the diabetes team).
EDUCATION AND SUPPORT

All patients with diabetes and their relatives and carers should receive information about diabetic emergencies. Key points to address include:

- The potential consequences of diabetic emergencies;
- How diabetic emergencies can be prevented;
- Be able to identify the early signs of diabetic emergencies and know what action they should take;
- Know what action to take during intercurrent illness i.e. 'sick day rules'.

REFERENCES


When patients with diabetes mellitus are being artificially fed via the enteral route (e.g. nasogastric, gastrostomy or jejunostomy) glycaemic control can prove difficult. This may complicate their medical condition and delay recovery. To maintain optimal glycaemic control while ill and receiving enteral nutrition, patients may require alteration of their usual diabetes treatment. It is imperative that there is good communication between the diabetes team, the nutrition support dietitian and the extended medical teams.

These guidelines are aimed at patients who:

1. Are currently on 24 hour feeding and intravenous insulin being transferred to subcutaneous insulin;
2. Have pre-existing diabetes and require enteral feeding;
3. Develop hyperglycaemia while being enterally fed.

TARGET GLYCAEMIC CONTROL

For patients being enterally fed, the extremes of glycaemic control should be avoided. A target blood glucose reading should be between 6 and 12 mmol/l. These targets should be adjusted according to individual patient requirements.

DIABETES THERAPY

The majority of patients with diabetes will experience a rise in their blood glucose levels when they commence enteral nutrition. There are often other factors such as infection and recent surgery that will affect glycaemic control. The following principles should be adhered to:

- Oral hypoglycaemic agents may not provide adequate glycaemic control, in this instance the patient should usually be converted to insulin and the oral hypoglycaemic agent should be discontinued;
- The usual therapy of choice is insulin, initially via an intravenous sliding scale.

**Insulin IV sliding scale regimen**

Add 50 units of soluble insulin (Actrapid® or Humulin S®) to 50 ml of 0.9% sodium chloride in a 50 ml syringe. Infuse IV using a pump and adjust according to sliding scale:

<table>
<thead>
<tr>
<th>Blood glucose (mmol/L)</th>
<th>Infusion Rate (units/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>0</td>
</tr>
<tr>
<td>5.1 – 10</td>
<td>1</td>
</tr>
<tr>
<td>10.1 – 15</td>
<td>2</td>
</tr>
<tr>
<td>15.1 – 20</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 20.1</td>
<td>4 and call a doctor</td>
</tr>
</tbody>
</table>
• Sliding scale regimens need to be re-evaluated frequently as insulin doses may need to be adjusted to achieve target glycaemic control;

• Once the patient’s blood glucose is stabilised and feeding has been established, he/she should be converted to subcutaneous insulin injections;

• The intravenous infusion must be discontinued once the initial subcutaneous injection has been administered;

• Subcutaneous insulin dose can be calculated as follows:
  1. Take an average of the patients 24 hour insulin requirements on the intravenous sliding scale;
  2. Subtract 25% from this value and this will be their TOTAL DAILY INSULIN DOSE;
  3. This will usually be split into 2 or more injections, see section on feeding regimens.

• Retrospective treating with corrective doses of subcutaneous insulin should be avoided and the insulin doses should be increased prospectively i.e. avoid boluses of short acting insulin.

MAINTAINING GLYCAEMIC CONTROL

• If the feed stops unexpectedly, blood glucose levels should be closely monitored, as patients are at risk of hypoglycaemia. If necessary, an intravenous dextrose infusion should be commenced until feeding can be resumed.

• If feed is stopped electively the patient may require to recommence intravenous insulin and dextrose, depending on length of fast.

ENTERAL FEEDING REGIMES

For inpatients with diabetes, the enteral feeding regimen will be recommended by the dietitian to meet the individual’s nutritional requirements. To maximise glycaemic control, we suggest using the following feeding regimens.

Intermittent feeding –
1. This may commence at varying times and be of variable duration (minimum 12 hours, maximum 20 hours).
2. The total daily insulin dose is calculated as above. (i.e. average 24 hour intravenous requirements minus 25%)
3. 2/3 of the dose is administered as pre-mixed 30/70 insulin (Humulin M3) at the start of the feed. The intravenous insulin should be discontinued after the first subcutaneous insulin has been administered.
4. The other 1/3 of the dose is administered as isophane (either Insulatard or Humulin I) at 12 hours.

Bolus feeding –
1. The feed is divided into at least 4 boluses, ensuring the carbohydrate intake is evenly distributed throughout the day, to mimic breakfast, lunch, dinner, supper and between meal snacks.
2. The total daily insulin dose is calculated as above. (i.e. average 24 hour intravenous requirements minus 25%).
3. 2/3 of the dose is administered as pre-mixed 30/70 insulin (Humulin M3) before the breakfast bolus. The intravenous insulin should be discontinued after the first subcutaneous insulin has been administered.

4. The other 1/3 of the dose is administered as pre-mixed 30/70 insulin (Humulin M3) around 9-10 hours later before the dinner bolus.

Glycaemic control should be closely monitored and insulin doses should be adjusted accordingly. If advice on insulin adjustment is required, contact the diabetes team.

KEY POINTS

- Hypoglycaemia is a medical emergency and should be treated urgently. If the patient is on IV insulin, stop the pump immediately. To treat hypoglycaemia, administer 100mls of Lucozade (available from pharmacy) via the feeding tube, if the hypoglycaemia is not resolving within 5 minutes, repeat. You must always follow up with another feed bolus or by re-commencing the feed to prevent the blood glucose falling again. If the tube has been dislodged or the patient is unconscious you will need to gain IV access and bolus IV Dextrose as per the section on treatment of hypoglycaemia.

- For patients receiving enteral nutrition, extremes of glycaemia should be avoided and target blood glucose levels should be between 6 and 12 mmol/l. All patients with type 1 diabetes must have their urine checked for ketones daily.

- Patients receiving enteral nutrition need to be reviewed by the secondary care diabetes team for management.

- Patients with diabetes who are commenced on enteral feed will usually require an increase in their diabetes medication or conversion into insulin.

- If a patient on enteral nutrition becomes hyperglycaemic, then the diabetes therapy needs adjusting, rather than a reduction in nutrition. This usually requires an increase in the insulin dose.

- Communication between the diabetes team and all of the healthcare professionals looking after the patient is vital and the targets for blood glucose control should be established for the individual patient, avoiding hypoglycaemia.

- As the patient’s clinical condition improves and their activity levels increase, insulin requirements may reduce significantly. If the patient comes off enteral feeding and returns to normal eating, they should usually return to their pre-illness diabetes regimen.

- On discharge home patients should be referred to the community diabetes team for follow-up and support, e.g. by the Community Diabetes Specialist Nurse or Dietitian.

- Patients with a life limiting illness should also be referred to the community team for support.
CARDIOVASCULAR DISEASE

Individuals with symptoms of cardiovascular disease or who are over the age of 40 years and have Type 1 or Type 2 diabetes should be considered at high risk (>= 30% risk over 10 years) of cardiovascular events.

Angina

- Diabetic patients with angina should be managed in accordance with the NHSGGC guideline for the management of angina. Diabetic patients with new-onset chest pain suggestive of coronary heart disease should be referred for fast track chest pain assessment in accordance with this guideline.
- Beta-blocker therapy (or a rate-limiting calcium channel blocker, long-acting nitrate or nicorandil in those intolerant of beta-blockers) should be commenced for first line symptomatic treatment in accordance with the GGCNHS angina guideline. Insulin therapy is not a contraindication to the use of B-blockers.
- ACE inhibitors should be given to patients with diabetes and any of the following:
  - post MI with or without left ventricular dysfunction;
  - heart failure due to left ventricular dysfunction;
  - cardiovascular, cerebrovascular or peripheral arterial disease.
- Statin therapy to reduce cholesterol should be initiated according to the GGCNHS cholesterol guidelines.
- Aspirin (75mg per day) should be given routinely and continued long term in patients with diabetes and existing cardiovascular disease in accordance with the GGCNHS guideline on anti-platelet therapy.
- Diabetic patients with worsening symptoms of angina despite medical therapy should be re-referred to cardiology in accordance with the GGCNHS angina guideline.

Myocardial Infarction and Acute Coronary Syndromes

- Patients with diabetes should be treated as all other STEMIls.
- All should receive intensive insulin treatment for at least 24 hours following acute MI. (see page 67).

Antiplatelet Therapy

There is a lack of evidence for benefit from low-dose aspirin therapy in reducing cardiovascular events when used for primary prevention in people with diabetes, and evidence of harm with an increase in gastrointestinal bleeding and haemorrhagic strokes. Low-dose aspirin is not recommended for primary prevention of vascular disease in patients with diabetes.
MANAGEMENT OF HYPERTENSION IN TYPE 2 DIABETES

The reader is directed to the NHS GGC guidelines for The Diagnosis and Management of Hypertension. These guidelines describe the correct methods for BP measurement as well as an algorithm for diagnosing hypertension.

A target BP of 130/80mmHg is recommended for patients with type 2 diabetes. In non-acute stroke and diabetic nephropathy, there is evidence of benefit from lowering blood pressure well below this target. It is recognised that despite best practice, such targets may not be reached in all patients.

Prescribing guidelines

1. The GGCNHS guidelines recommend the A C D algorithm (A = ACE-I or Angiotensin II receptor blocker, C = calcium channel blocker, D = diuretic).
2. People who are younger than 55 years and white tend to have higher renin concentrations than those who are older than 55 or black. (A) drugs are therefore recommended in particular as initial therapy in white patients < 55 years.
3. Beta-blockers are now relegated to fourth-line agents.
4. ACE-I therapy and/or A II receptor blockers are recommended as first line treatment for patients with type 2 diabetes who have microalbuminuria or proteinuria. (A II receptor blockers are restricted to patients with significant cough on ACE-Is.) These drugs appear to slow progression of renal damage compared to other drugs for a given BP reduction.
5. With the exception of BFZ, the starting dose of a drug can be increased if BP remains above target. If there is no further effect from an increased dose or if side effects develop, then the lower dose should be reinstated. If the addition of a drug shows no benefit or is not tolerated then it should be discontinued. Smaller doses of 2 or more drugs rather than larger doses of one drug may give a better efficacy/tolerability profile.
Hypercholesterolemia is an important reversible risk factor for cardiovascular disease and should be tackled aggressively in all diabetic patients.

- In Type 1 patients, normal or high HDL-cholesterol concentrations are often seen. However, an elevated HDL-cholesterol is not associated with the same cardio-protective effect as in non-diabetic individuals.
- The characteristic dyslipidaemia of type 2 diabetes is mild hypercholesterolemia, low HDL-cholesterol and hypertriglyceridemia.
- Triglyceride concentrations are elevated by poor diabetic control. Triglycerides may improve with good diabetic control, attention to diet, reduced alcohol consumption and an increase in exercise. Otherwise, drug treatment may be indicated.

Screening for Dyslipidaemia

- In most cases lipids are checked yearly at the annual review.
- Assess more frequently (4-6 months), if lipid-lowering therapy is prescribed – to ensure compliance and reaching of targets.

WHICH SAMPLES SHOULD BE ASSESSED?

- Total cholesterol, and triglycerides should be requested. For ease, non-fasting estimation is usually adequate.

MANAGEMENT (See GGC Lipid Guidelines)

1. Lifestyle Advice
   - Reinforce dietary advice and optimise glycaemic control.
   - Provide weight reduction diet for those with BMI > 25.
   - If BMI > 30, set target of 5-10 kg weight loss.
   - Increase fruit and vegetable consumption (5 portions per day).
   - Increase oily fish consumption (2 portions per week).
   - Reduce saturated fat intake.
   - Encourage regular exercise.

Exclude (and treat) Secondary Causes of Hypercholesterolemia

- Hyperthyroidism.
- Nephrotic Syndrome.
- Cholestasis.
- Drugs (e.g. diuretics, corticosteroids).

1. Patients with type 1 or 2 diabetes < 40 years and other important risk factors e.g. microalbuminuria, should be considered for primary prevention lipid-lowering drug therapy with simvastatin 40 mg.

2. Patients with diabetes > or = 40 years of age are at high risk and should be treated as per secondary prevention.
For full guidance in the management of dyslipidaemia please refer to the NHS GGC Guideline for the Management of Cholesterol. This can be accessed via Staffnet at the following web address.


or at the NHS GGC website, web address

http://library.nhsggc.org.uk/mediaAssets/My%20HSD/37390_Cholesterol_GUIDELINES[1].pdf
All patients should have their eyes examined at least annually for detection of diabetic retinopathy. Diabetic retinopathy is the commonest cause of blindness in the 30-65 age group in the UK at the present time. Development or progression of retinopathy can be prevented by good glycaemic control, management of hypertension and avoidance of smoking.

- It is reasonable to aim for a target HbA1c of < 7.0% and blood pressure <130/80 mmHg to limit development and progression of microvascular complications, including retinopathy. Laser treatment is indicated for proliferative diabetic retinopathy and maculopathy. It is more likely to be effective if applied at an early stage when the patient is more likely to be asymptomatic; therefore screening for retinopathy is vital.

- Laser therapy is not always effective in all patients.

- Retinopathy may be present in up to a third of newly diagnosed type 2 diabetic patients.

- Some degree of retinopathy will also be present in the majority of patients who have had diabetes for more than 20 years and a significant number, particularly if poorly controlled, will develop retinopathy at an earlier stage.

Screening within the former GGHB area is currently performed in accordance with SIGN guidelines and the NHSQIS recommendations. In practice, this means annual non-mydriatic fundus photography with mydriatic fundus photography if initial photographs are unsatisfactory. If the latter are unhelpful then slit-lamp biomicroscopy is undertaken by optometrists (opticians). Referral to an ophthalmology clinic is undertaken for slit-lamp biomicroscopy. Retinal cameras are located at Glasgow Royal Infirmary and Gartnervel General Hospital in north Glasgow and at the Victoria Infirmary and the Southern General sites in south Glasgow. The screening service in Glasgow also has one van with a retinal camera which provides a service to outlying areas.

In the former Argyll and Clyde area there are retinal cameras at Paisley RAH and Inverclyde Royal infirmary as well as a mobile van service for north of the River Clyde.
SCREENING OF THE DIABETIC FOOT

People with diabetes should be screened to assess their risk of developing a foot ulcer (SIGN 116) The risk calculation tool on SCI-DC Network can be used.

The results of screening should be logged electronically on SCI-DC Network or equivalent. This allows accurate risk stratification and advice on referral / future management (see figure on page 43). Foot screening should include vascular, neurological, foot structure and categorisation of risk.

Foot care education is recommended as part of a multidisciplinary approach in all patients with diabetes.

VASCULAR ASSESSMENT

Look for signs or symptoms of:

- Rest pain;
- Claudication (can be absent due to neuropathy);
- Thin shiny skin without hair growth;
- Atrophy of subcutaneous tissue;
- Dusky red appearance or cyanotic blue;
- Acute ischaemia – pale foot often with purple mottling.

Check pulses:

- Dorsalis Pedis;
- Posterior Tibial;
- Record previous amputation(s);
- Record previous vascular interventions.

If there is evidence of significant vascular obstruction (e.g. rest pain, acute ischaemia or gangrene) there should be an urgent referral to specialist vascular services.

NEUROLOGICAL ASSESSMENT

- Test ten set points on the feet using a 10g Monofilament. Two or more absent areas on each foot indicate neuropathy.

- Record evidence of painful neuropathy.

Other Risk Factors:

- Document foot deformity.
- Document evidence of significant callus.
- Record current or previous ulceration.
Once this data is recorded risk stratification and management advice is automatically generated via SCI-DC.

Low Risk

- Self management.
- Annual assessment.
- Education.
- Routine self care.
- Access to podiatry if required.

Moderate Risk

- Annual screening.
- Education.
- Regular routine podiatry.
High Risk

- Regular review/treatment by Podiatrist.

Active Foot Disease

- Rapid access to multidisciplinary foot team.

**ACTIVE DIABETIC FOOT DISEASE**

Patients with active diabetic foot disease should be referred to a multidisciplinary diabetic foot care service.

Hot, Swollen, Red Foot

This is a diabetic emergency. Any patient with a hot, swollen, red foot needs urgent assessment. The differential diagnosis includes charcot arthropathy & infection both of which are emergencies.

(a) Charcot arthropathy: occurs in up to 10% of patients with neuropathy.
- Swelling, pain & temperature difference.
- Signs of gross deformity.
- Initial x-ray & inflammatory markers.
- Urgent immobilisation.
- Urgent referral to secondary care.

(b) Acute infection: urgent referral as detailed above.

Foot Ulceration

All diabetic patients presenting with foot ulceration should be referred to the diabetes multidisciplinary clinic or specialist diabetes podiatrist urgent assessment of the following:

- Wound History Diabetic assessment tool;
- Wound Management Sharp debridement by specialist podiatrist, Larvae therapy by specialist podiatrist;
- Mechanical Assessment Immobilisation/pressure relief, Review/referral by Orthotist;
- Vascular Assessment Doppler/ankle brachial pressure, Referral to vascular services;
- Neurological Assessment 10g monofilament;
- Metabolic Assessment Liaise with Diabetic Specialist Nurse;
- Infection Assessment Wound swabs/screen for MRSA/x-ray.

Foot Infections

Admit if clinical concern or sepsis diagnosed with 2 or more of the following:

- Temp >38°C or <36°C;
- Heart rate >90 bpm;
• Resp rate >20 pm;
• WCC <4 or >12.

If IV antibiotics are needed but otherwise suitable for discharge then consider Outpatient Home Antibiotics (OPHAT) where available.

Antibiotic Therapy

Several local protocols already exist for diabetic foot infections. Please liaise with your local microbiologist & multidisciplinary foot team for further advice.

Topical Antimicrobials

If clean wound present and no clinical signs of infection use an appropriate topical antimicrobial dressing (Aquacel Silver, Inadine, Iodosorb).

In non-severe soft tissue infections where osteomyelitis is not suspected use Flucloxacillin 1G qid or Clindamycin 450mg TDS if the patient is penicillin allergic. Add Metronidazole 400mg tid if vascular compromise. Seven day course, then review. Swab for sensitivities if MRSA or unusual organism is suspected.

*** Patients with severe infection and cellulitis need admitted as an emergency for intravenous antibiotics and further assessment ***

Osteomyelitis

20% of patients with a neuropathic ulceration and 10% of patients with a neuro-ischaemic ulceration will develop osteomyelitis. Look for the following clinical features:

• Gross swelling of area/digit may take on ‘sausage’ appearance;
• Probe to bone or exposed bone;
• New pain in a neuropathic foot;
• Previous osteomyelitis;
• Unexplained wound healing;
• X-ray diagnosis – radiological changes may take six weeks to develop therefore repeat x-ray is often useful if the first x-ray has no changes;
• Consider MRI if diagnostic doubt following repeat x-ray;
• Immobilisation of the area;
• Refer to multidisciplinary team/Diabetes Specialist Podiatrist.

Use Clindamycin 600mg tds. or Flucloxacillin 1G qds. for 6 – 12 weeks. Consider adding rifampicin 450mg bd. or sodium fusidate 500mg tds but check for drug interactions (eg. Statins). Modify antibiotic therapy depending on microbiology.

Diabetic Painful Neuropathy (DPN)

Distal symmetrical polyneuropathy is the commonest type of diabetic neuropathy and affects primarily the sensory and autonomic nerve fibres. Point prevalence is approximately 10%. Painful diabetic neuropathy is a distressing condition causing burning, tingling or shooting pains usually in the feet and typically worse at night and relieved by walking. Clinical signs of neuropathy may or may not be present on
examination. Optimising glycaemic control with avoidance of swings in glucose control is probably more important than the absolute level.

- Consider other causes (e.g. B12 deficiency) and reduce alcohol consumption if excessive.
- Explain nature of condition and involve support from podiatrist/DSN.
- No treatment will be expected to completely resolve pain.
- Simple analgesia/NSAIDs are seldom effective and only of use if symptoms are very mild.
- The initial treatment is dependent on individual patient choice, dosing regimens, cost and side effect profile
- Start at the appropriate dose and increase as clinically indicated. Advise patient it may take several weeks to see a response.
- Combination therapy is often useful.
- All treatments should be reviewed regularly and stopped if ineffective.
- If above approach has not helped discuss with Consultant for consideration of other treatments or pain clinic referral.

TREATMENT FOR PAINFUL NEUROPATHY

These guidelines are consistent with the SIGN 116

Antidepressants, including tricyclics, duloxetine and venlafaxine should be considered for the treatment of patients with painful DPN.

Anticonvulsants, including pregabalin and gabapentin should be considered for the treatment of patients with painful DPN.

Opiate analgesia in combination with pregabalin or gabapentin should be considered for the treatment of patients with painful DPN which cannot be controlled with monotherapy.

Amitriptyline

25 mg at night increasing in 25 mg increments (start at 10 mg if patient over 70 years and increase in 10 mg increments) to 100 mg maximum dose if required and tolerated.

- Caution in cardiovascular disease.
- Main side effects drowsiness, dry mouth and urinary retention.
- Advise patient that the reason for use is not as an antidepressant. Pain may not be relieved immediately.
- Take at night to minimise drowsiness. Side effects may reduce with time.

Pregabalin
150mg daily in 2-3 divided doses increasing if necessary after 3-7 days to 300mg daily in 2-3 divided doses and if needed to a maximum dose of 600mg per day after an additional 7 day interval.

- Cautions: avoid abrupt withdrawal and in severe CHF.
- Main side effects are dizziness and somnolence.
- Advise patient will not relieve pain immediately and that reason for use is not as an anticonvulsant.

**Gabapentin**

300 mg increasing by 300 mg a day to 900 mg and then by 300 mg every 3 days to 1800 mg a day in divided doses as tolerated (up to 900 mg three times daily if responding/tolerating). In frail/elderly, start with 100 mg three times daily increasing by this amount every week to a maximum dose of 1800 mg daily if tolerated.

- As titration regime complicated it should be given to patient in written form.
- Main side effects are dry mouth, dizziness, tiredness and tremor.
- Advise patient will not relieve pain immediately (allow four weeks at reasonable dose) and that reason for use is not as an anticonvulsant.

**Duloxetine**

The dose is 60mg once daily.

- Main side effects are gastrointestinal; nausea, vomiting, dyspepsia, diarrhoea, constipation.
- Caution in the elderly, cardiac disease and hypertension (avoid if uncontrolled).
- Should not be stopped abruptly. Reduce dose over at least 1 – 2 weeks.
- Advise patient that it is not being used as an anti-depressant.

**Opiods**

- Select patients – no history of substance misuse.
- Explain use to patient – safe when used appropriately but requires monitoring. Not addictive but may have physical dependence – withdraw slowly.
- Use sustained release preparation.
- Proven to be effective in combination with Gabapentin.
Diabetic nephropathy is detected clinically by the presence of albuminuria (24h urine albumin >300mg; first pass morning urine albumin/creatinine ratio >3mg/mmol) and is a leading cause of end-stage renal failure.

The time course to diabetic nephropathy is usually 15-25 years following the onset of diabetes. It may appear shorter in type 2 patients as diabetes may have been undetected for several years.

Risk factors for the development of diabetic nephropathy include poor glycaemic control, family history, hypertension, black race (type 2 DM), male sex, advancing age, dyslipidaemia and smoking.

Early detection and effective treatment can slow progression of nephropathy, therefore screening is vitally important.

The possibility of non-diabetic renal disease should be considered if atypical features are present: rapid onset; absence of retinopathy; asymmetric kidneys on ultrasound scanning; haematuria; drop in eGFR of >30% after initiation of ACE-I or ARB.

The natural course of diabetic renal disease may be summarised as follows.

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Renal hyperperfusion and hypertrophy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Occurs at time of diagnosis of type 1 diabetes mellitus.</td>
</tr>
<tr>
<td></td>
<td>Serum creatinine and urine albumin excretion normal.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage 2</th>
<th>Asymptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lasts around 10 years. GFR increased.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage 3</th>
<th>Microalbuminuria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Alb/Creat Ratio &gt;2.5mg/mmol [male], &gt;3.5mg/mmol [female]; 24h urine albumin 30-300mg). Untreated, 80% will progress to overt nephropathy (type 1). Serum creatinine typically normal although eGFR may be reduced.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage 4</th>
<th>Albuminuria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Alb/Creat Ratio &gt;30mg/mmol; 24h urine albumin &gt;300mg). Dipstick positive proteinuria. Occurs around 15-20 years after diagnosis of diabetes. Untreated, eGFR drops by around 10ml/min/year.</td>
</tr>
</tbody>
</table>

| Stage 5 | End-stage renal failure |
SCREENING

1. All patients with diabetes mellitus should have screening for microalbuminuria and measurement of eGFR annually.
2. First pass morning urine should be sent in a clean (white top) universal container to biochemistry for albumin/creatinine ratio.
3. An abnormal result should be confirmed as soon as possible with a second sample along with MSSU to exclude concurrent infection.
4. Microalbuminuria in type 2 diabetes is also a marker for increased cardiovascular risk.
Note: Formulary restriction to use of ATRBs: see hypertension prescribing guidelines above

Individuals with diabetes and mild to moderate chronic kidney disease should be managed in a setting that can provide appropriate investigation, monitoring and intensive clinical management.

**TREATMENT (WHEN MICROALBUMINURIA OR ALBUMINURIA CONFIRMED)**

1. Apply aggressive blood pressure targets:
   - Type 1 diabetes <120/70 mm/Hg;
   - Type 2 diabetes <130/80 mm/Hg (lower if heavy proteinuria).
   Reduce blood pressure to the lowest achievable level.

2. Start ACE-I if not already in use or contraindicated. Titrate to the maximum tolerated dose. Consider angiotension receptor blocker (ARB) if ACE-I not tolerated or type 2 diabetes with late nephropathy (albuminuria).
   (Remember the possibility of foetal loss and teratogenesis in females of child-bearing age).

3. If BP target not achieved on maximum dose of ACE-I or ARB, add a calcium channel blocker or consider combining ACE-I and ARB with careful monitoring of U+E.

4. Maintain intensive glycaemic control.

5. Smoking cessation advice.

6. Introduce statin and aspirin unless contraindicated.

7. Dietary advice on salt intake and weight loss.

**MANAGEMENT OF ANAEMIA**

Patients with diabetes and chronic kidney disease stage 3 – 5 should have their haemoglobin checked at least annually. Consider erythropoiesis stimulating agents in all patients with chronic kidney disease.

**CRITERIA FOR REFERRAL TO RENAL CLINIC**

1. Suspicion of non-diabetic renal disease:
   - Microscopic or macroscopic haematuria;
   - Rapid decline in eGFR;
   - Rapid onset of proteinuria;
   - Fall in eGFR of >30% after initiation of ACE-I or ARB;
   - Asymmetric kidneys on ultrasound scanning;
   - Clinical features of vasculitis or systemic disease e.g. rash, positive ANF;
   - No diabetic retinopathy (progressive stage 3 CKD).

2. Stage 4 or 5 CKD (eGFR <30ml/min).
3. Stage 3 CKD (eGFR 30-59ml/min) with progressive decline in eGFR.

4. Stage 3 CKD with other features e.g. microscopic haematuria, problematic hypertension, electrolyte disturbance, acidosis.

5. Significant proteinuria (protein/creatinine ratio >45mg/mmol; ) or nephrotic syndrome.

If in doubt, discuss with local nephrologists.
MALE ERECTILE DYSFUNCTION

Erectile dysfunction occurs in 30% of all diabetic men and affects 55% of those aged over 60 years. In diabetic men, risk factors include hypertension; smoking; vascular disease; duration of diabetes and poor metabolic control. Drugs may also be responsible but it may be difficult to distinguish the effect of the drug from the effect of the underlying reason for which the drug is prescribed. A clear temporal relationship may help. Testosterone deficiency and hyperprolactinaemia are rare causes. Psychological factors may also be wholly or partly responsible.

HISTORY

(a) Clearly define the problem
   (i) Loss of libido – may point to psychological or endocrine cause
   (ii) Failure of erection
   (iii) Failure of ejaculation
   (iv) Premature ejaculation
   (v) Other painful conditions of the penis e.g. balanitis, phimosis or Peyronie’s disease.

(b) Differentiate between psychological and organic cause.

<table>
<thead>
<tr>
<th>PSYCHOGENIC</th>
<th>ORGANIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the onset rapid?</td>
<td>Was the onset gradual?</td>
</tr>
<tr>
<td>Is there an inconsistent response varying with time/partner?</td>
<td>Is lack of response consistent?</td>
</tr>
<tr>
<td>Are morning/nocturnal erections still present?</td>
<td>Have morning/nocturnal erections stopped?</td>
</tr>
<tr>
<td>Is response to self stimulation still present?</td>
<td>Is there no response to self stimulation?</td>
</tr>
<tr>
<td>Has the patient had an important life event?</td>
<td>Does the patient have an underlying medical condition which may be contributing?</td>
</tr>
<tr>
<td>A yes response to most questions suggests and underlying psychological cause</td>
<td>A yes response to most questions suggests a primary organic cause</td>
</tr>
</tbody>
</table>

(c) How important is the problem and what are the patient’s expectations of treatment?
**EXAMINATION**

Look for secondary sexual characteristics, gynaecomastia, peripheral vascular disease, peripheral neuropathy and the appearance of the external genitalia.

**INVESTIGATION**

Testosterone, FSH, LH, prolactin.

**MANAGEMENT**

The initial investigation and management of patients with erectile dysfunction can be carried out in Primary Care. Patients who fail to respond to one PDE5 blocker at full dosage should be referred to secondary care for consideration of alternative therapies. Referral to the appropriate specialist will depend upon the particular service which is available locally. Patients considered to have a psychological cause for their erectile dysfunction could be referred to a clinical psychologist if such a service is available.

General measures:
- Stop smoking;
- Improve glycaemic control;
- Reduce alcohol intake;
- Withdraw causative drugs where possible.

Pharmacological treatment:
- Oral preparations; PDE5 blockers e.g. sildenafil, tadalafil and vardenafil;
- Apomorphine; (this is an off label use of this medication)
- Intra-cavernosal injection of vasoactive drugs e.g. alprostadil;
- Intra-urethral agents e.g. alprostadil.
- Vacuum devices and surgical treatment

Some vacuum devices are available on prescription or may be available from the local urologist.

**Hypogonadism**

Hypogonadism is not uncommon in male patients with diabetes. The finding of a testosterone concentration which is below the normal laboratory range however does not always signify clinically important hypogonadism. The flow chart below should guide the initial investigation of the diabetic male in whom hypogonadism is suspected.
Past medical history & physical examination

Measure serum testosterone (T) levels between 7-11am

T >12nmol/l
- Consider alternative diagnoses
  - T >12nmol/L, normal Prolactin and FSH/LH
  - T 8-12nmol/L, normal Prolactin and FSH/LH
  - T 8-12nmol/L, and ↑ Prolactin or abnormal FSH/LH

T ≤12nmol/l
- Repeat T level
  - Measure FSH, LH & Prolactin
  - Repeat tests

HYPOGONADISM
- Refer to endocrine clinic

Diabetic patient presents with 2 or more of the following:
  - Loss of libido
  - Lack of response to PDE-5 inhibitors
  - Unexplained anaemia
  - Premature osteoporosis
  - Non-specific symptoms – fatigue, low mood, poor concentration, reduced muscle mass, reduced well-being.
The hazards of treatment are greater in the elderly and the benefits possibly less. Abnormal blood glucose values may be less worrying than the disruption to a person's lifestyle that may be caused by injudicious treatment. The aim should be to keep the blood glucose in the range 8-13 mmol/l in order to avoid both hyperglycaemic symptoms and hypoglycaemic attacks.

The advice of a Dietician is important as simple and realistic dietary advice may be enough in some patients to give reasonable control. It is sensible to keep drug treatment to a minimum and to be aware of possible interactions. Metformin may be used in patients with normal renal function and liver function. For patients requiring Sulfonylurea treatment gliclazide is the preferred choice, especially if there is any renal impairment as this has hepatic rather than renal clearance. Long-acting Sulfonylureas such as glibenclamide and chlorpropamide should be avoided because of the risk of hypoglycaemia.

The introduction of insulin therapy to an elderly patient may render a previously independent patient, dependent upon district nurses or family members with subsequent loss of self esteem. Barriers to insulin therapy in the elderly can be:

1. Physical problems – poor eyesight, poor muscle coordination due to CVA, Parkinson's disease, rheumatism;
2. Cognitive problems – poor memory, inability to retain new information;
3. Psycho-social problems – inability to alter lifestyle.

Hypoglycaemia can be more troublesome in the elderly for several reasons:

1. Poor recognition and understanding of hypoglycaemia;
2. Increased susceptibility to alterations in cognitive function;
3. Impaired metabolism of insulin;
4. Impaired counter-regulatory responses;
5. Social isolation.

Hypoglycaemia should therefore be avoided at all costs.

Very elderly patients and patients who require a district nurse to administer the insulin injection, can often be treated with a single daily injection of long acting insulin or a once daily mixture of short and intermediate – or long acting insulin. The use of pre-set pen devices can be helpful.

As elderly patients often have a high renal threshold for glucose, urine tests may be misleading. Elderly patients using urine monitoring should have measurements of HbA1c at least twice yearly. Care of the feet including regular chiropody is particularly important for elderly patients. Regular reviews, including checks on feet, eyes, urine protein and blood pressure are as important as in younger patients. Many patients will have microvascular and macrovascular complications at the time of diagnosis of diabetes.
INTRODUCTION
Type 1 diabetes is a high-risk state for both the women and her foetus. Rates of foetal and neonatal loss and major congenital malformation are increased at least two to threefold. Type 2 diabetes is becoming more common in this age group and management should follow the same intensive program of metabolic, obstetric and neonatal supervision.

AIM
An optimal outcome may be obtained in diabetic pregnancy if excellent glycaemic control is achieved before and during pregnancy. Good contraception and pre-pregnancy planning are thus essential.

CONTRACEPTION
Contraception should be discussed on an individual basis with all women of childbearing age with diabetes. In general, the contraceptive advice for a diabetic woman should follow that in the general population but with the following caveats:
• The combined OCP should be avoided in women with complications or risk factors for vascular disease or over 35 years of age. Progesterone-only preparations may be suited in these women.
• Women using the intrauterine contraceptive device should be advised that they might be at increased risk of infection.

In women with complications or vascular risk a value judgement must be made which balances the risk of complications with the need to avoid pregnancy. The levonorgestrel-releasing intrauterine device (Mirena coil) may be particularly suited as it is as effective as sterilisation and produces low circulating hormone levels.

PRE-PREGNANCY CARE
Infants whose mothers receive dedicated multidisciplinary pre-pregnancy counselling show significantly fewer major congenital malformations (approximating to the rate in non diabetic women) compared to infants of non-attendees. They also have fewer immediate problems and are kept in special care for shorter periods.
All women who are planning a pregnancy should be seen at a Multidisciplinary Clinic involving a diabetologist, obstetrician, diabetes nurse specialist, and dietician. They should be seen with their partners if possible and provided with written information.
• Full medical, obstetric and gynaecological history.
• Check rubella status and thyroid function.
• Review current medications.
• STOP Ace Inhibitors, A2 Blockers, Statins, Thiazolidinediones and Sulfonylureas.
• Prescribe Folate 5mg daily for at least 1-month pre conception and for 1st trimester.
• Screen for complications.
• Advice on diet and weight reduction if relevant and strongly discourage smoking.
• Educate on the importance of near normal glycaemia control.
• Instruct partners to recognise and treat hypoglycaemia with glucagon if necessary.
• Support improvements in glycaemic control including access to structured education where appropriate.
Women who are well controlled and free from complications should take 1 month’s folic acid prior to stopping contraception and keep a record of periods. Others should spend additional time optimising control and having complications investigated and treated. Women should perform a pregnancy test if there is a lapse of 5 weeks between periods and contact the Diabetes Specialist Nurse if positive.

ANTE-NATAL CARE
Care should be hospital based, from a multi-disciplinary team. Women attend every 2 to 4 weeks until 30 weeks and then every 1-2 weeks thereafter.

CONTROL
• Individualised insulin regimens with regular monitoring before and after meals.
• Remember insulin requirements may drop during the 1st trimester and then progressively increase.

METABOLIC COMPLICATIONS
• Hypoglycaemia with loss of awareness more common in 1st trimester. It has no long-term adverse effects on foetal development.
• Ketoacidosis can cause foetal death at any stage. All women should check urinary ketones if unwell or if blood glucose is high.

MICROVASCULAR COMPLICATIONS
• Diabetic retinopathy and nephropathy can deteriorate during pregnancy.
• Dilated fundoscopy or retinal imaging should be performed at booking and during each trimester with referral if moderate background retinopathy is detected.
• Blood pressure should be monitored regularly with consideration of antihypertensive therapy where BP > 135/85 or significant proteinuria (>300mg per 24 hours or Protein: creatinine ratio > 30mg/mmol)
Aspirin should be considered from 12 weeks

TIMING AND MODE OF DELIVERY
• The timing and mode of delivery is individualised and in women with good control and no complications is usually planned for the 38th week.
• Women with diabetes have a higher caesarean section rate even after controlling for confounding factors.

INFANTS OF DIABETIC MOTHERS
• A Paediatrician skilled in resuscitation should be present at the delivery of all women with diabetes.
• Neonatal hypoglycaemia is defined at <2.6mmol/l and is associated with adverse short and long term neurodevelopment.
• Early feeding is advised to avoid hypos.

POST NATAL CARE
• Insulin requirements fall dramatically after delivery-reduce dose to pre-conception dose.
• In breast feeding mothers reduce this further and encourage higher blood sugars than pregnancy.
• Discuss contraception prior to discharge.
• All women should be reviewed at the clinic in 6 weeks.
GESTATIONAL DIABETES

The diagnosis of gestational diagnosis is under review at present with differing guidelines from NICE, SIGN and the International Association of Diabetes in Pregnancy Study Groups (IADPSG). Recent evidence supports the view that detection and management of gestational diabetes reduces birth weight and some maternal adverse outcomes such as pre-eclampsia. Dietary management is the key first step in management. All of the above guidelines suggest more extensive screening for gestational diabetes than that currently in place in centres in GG&C - full implementation will require alterations in current services locally.

The current SIGN 116 guideline suggests that:

Screening at first antenatal visit
At booking all women should be assessed for the presence of risk factors for gestational diabetes (see table).

<table>
<thead>
<tr>
<th>Table: Risk factors for gestational diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI more than 30 kg/m²</td>
</tr>
<tr>
<td>Previous macrosomic baby weighing 4.5 kg or more</td>
</tr>
<tr>
<td>Previous gestational diabetes</td>
</tr>
<tr>
<td>Family history of diabetes (first degree relative with diabetes)</td>
</tr>
<tr>
<td>Family origin with a high prevalence of diabetes:</td>
</tr>
<tr>
<td>- South Asian (specifically women whose country of family origin is India, Pakistan or Bangladesh)</td>
</tr>
<tr>
<td>- Black Caribbean</td>
</tr>
<tr>
<td>- Middle Eastern (specifically women whose country of family origin is Saudi Arabia, United Arab Emirates, Iraq, Jordan, Syria, Oman, Qatar, Kuwait, Lebanon or Egypt).</td>
</tr>
</tbody>
</table>

All women with risk factors should have HbA1c or fasting glucose measured.
- Women in early pregnancy with levels of HbA1c ≥ 6.5% (48 mmol/mol), fasting ≥ 7.0 mmol/l or two hour ≥ 11.1 mmol/l glucose diagnostic of diabetes should be treated as having pre-existing diabetes.
- Women with intermediate levels of glucose (HbA1c 6.0 to 6.4% or 42 to 46 mmol/mol), fasting glucose 5.1 to 6.9 mmol/l or two hour glucose 8.6 to 11.0 mmol/l should be assessed to determine the need for immediate home glucose monitoring and, if the diagnosis remains unclear, assessed for gestational diabetes by 75 g OGTT at 24-28 weeks.

Screening later in pregnancy
All women with risk factors (Table) should have a 75 g OGTT at 24-28 weeks. A fasting plasma glucose at 24-28 weeks is recommended in low-risk women.

Diagnosis
The adoption of internationally agreed criteria for gestational diabetes using 75 g OGTT is recommended:
- fasting venous plasma glucose ≥ 5.1 mmol/l, or
- one hour value ≥ 10 mmol/l, or
- two hours after OGTT ≥ 8.5 mmol/l.
MANAGEMENT
• Women with gestational diabetes should have access to dietary advice from a dietician as well as consideration of treatment with metformin and/or insulin starting either with referral to the local multidisciplinary clinic or under a protocol agreed by that clinic
• Women with frank diabetes by non-pregnant criteria (fasting venous glucose ≥7 mmol/l, two hour ≥11.1 mmol/l) should be managed within a multidisciplinary clinic as they may have type 1 or type 2 diabetes and be at risk of pregnancy outcomes similar to those of women with pre-gestational diabetes.

FOLLOW-UP
• Annual fasting plasma glucose should be checked in the community in patients with GDM to detect asymptomatic diabetes and all future pregnancies should be screened.
• The benefit of exercise and weight loss should be highlighted in an effort to avoid future diabetes.

HORMONE REPLACEMENT THERAPY

The current place for HRT is under debate. Large observational studies had suggested a role for HRT in the prevention of cardiovascular disease in post-menopausal women. However, the latest randomised controlled trials in both primary prevention and secondary treatment have been stopped because of adverse outcomes in the HRT group. As such, HRT should be restricted to use for post-menopausal vasomotor symptom control.
PRACTICAL PROCEDURES

Patients with diabetes undergoing radiological procedures that require fasting. (e.g. abdominal ultrasound)

Aim for procedure to be undertaken first on morning list

Not on insulin

Omit OHA on morning of procedure. If concern of “hangover” effect from previous day’s OHA, commence 5% dextrose and monitor blood glucose. Recommence OHA once returned to normal diet.

On insulin treatment

If patient has type 2 diabetes, reduce preceding evening insulin by 30% and omit insulin on morning of procedure. Monitor blood glucose regularly and restart insulin at usual doses once on normal diet.

If patient has type 1 diabetes, ensure that patient is first on list. Reduce preceding evening insulin by 30% and delay morning insulin until after procedure and inject prior to a meal. Monitor blood glucose closely throughout.

Patients with diabetes undergoing radiological procedures that require intravenous contrast (e.g. coronary angiogram).

On metformin

There is no need to stop Metformin after contrast in patients with serum creatinine within the normal reference range and/or eGFR >60 mls/min. If serum creatinine is above the normal reference range or eGFR is below 60, any decision to stop it for 48hrs should be made in consultation with the referring clinician.
Patients with diabetes undergoing diagnostic procedures requiring fasting (eg upper GI endoscopy, transoesophageal ECHO, barium swallow).

Aim for procedure to be undertaken first on morning list

<table>
<thead>
<tr>
<th>Not on insulin</th>
<th>Omit OHA on morning of procedure. If concern of “hangover” effect from previous day’s OHA, commence 5% dextrose and monitor BMs. Recomence OHA once returned to normal diet</th>
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</thead>
<tbody>
<tr>
<td>On insulin treatment</td>
<td>If patient has type 2 diabetes, reduce preceding evening insulin by 30% and omit insulin on morning of procedure. Monitor BMs regularly. Restart insulin at usual doses if on normal diet later that day. Otherwise, commence sliding scale or GKI infusion at 0800 and continue until eating and drinking normally.</td>
</tr>
</tbody>
</table>

If patient has type 1 diabetes, ensure that patient is first on list. Reduce preceding evening insulin by 30%. If simple, short procedure, delay morning insulin until following procedure and inject prior to next meal. If procedure or recovery is likely to be metabolically stressful or prolonged (more than 1-2 hours), or if patient has comorbidity, commence sliding scale or GKI infusion at 0800 and continue until eating and drinking normally. Monitor blood glucose closely throughout.
Patients with diabetes undergoing colonoscopy or barium enema as day cases

Advice and action to be taken for patients with Type 2 diabetes on oral medication attending for colonoscopy

Should be advised to take Klean Prep preparation as per instructions

To take usual oral medications the day before colonoscopy as follows:

- If on long-acting Sulfonylureas (i.e. Glimepiride or Gliclazide MR) reduce dose by half i.e. Glimepiride 6mg – take 3mgs, Gliclazide MR 120mg – take 60mg
- If on short-acting Sulfonylurea (i.e. Gliclazide, Glipizide, Glibenclamide) or Repaglinide or Nateglinide, do not take any further doses once fasting has begun.
- If taking Metformin, Rosiglitazone, Pioglitazone or combination tablets (Competact, Avandamet), Sitagliptin, Vildagliptin, Saxagliptin or combination tablets (Eucreas), do not take any further doses once fasting has begun.
- If taking Exenatide, take morning injection only. If taking Liraglutide, reduce morning dose to 0.6mg injection

Withhold oral medications and injections of Exenatide/Liraglutide on morning of colonoscopy

Patients on Sulfonylureas are particularly at risk of hypoglycaemia. They should have glucose tablets, Lucozade, small can of coke or jelly babies/jelly beans (please avoid the red ones) at home and whilst travelling to hospital for their appointments, in case of hypoglycaemia.

Patient to bring oral medications with them to hospital

Check blood glucose (BG) levels prior to procedure and one hour post procedure if patient is still within the department:

Prior to colonoscopy
- If result above 4mmol/l, it is safe to proceed with colonoscopy
- If result is below 4mmol/l, provide patient with 3 dextrose tablets or ½ glass of Lucozade
- Recheck BG level in 15 minutes and repeat as necessary until results is above 4mmol/l

Post colonoscopy
- If result is above 4mmol/l and patient is being provided with a breakfast, usual dose of oral medication should be taken
- If level is below 4mmol/l, follow above procedure x 1 and provide breakfast
- Recheck BG level prior to giving oral medication

NB Ensure patient’s BG level is within acceptable limits (4-15mmol/l) prior to leaving the department; if any concerns contact the diabetes centre or medical staff
Advice and action to be taken for patients with Type 2 diabetes on once daily insulin attending for colonoscopy

Should be advised to take Klean Prep preparation as per instructions

To take insulin therapy the day before colonoscopy as follows:

- If on once daily insulin in the morning (e.g. Insulatard, Humulin l, Lantus, Levemir) take 1/3 off usual dose i.e. if on 36 units daily take 24 units.
- If on once daily insulin at any other time of the day, withhold insulin.
- If taking oral hypoglycaemics as well as insulin, please refer to advice sheet for type 2 patients on oral medications.

Patients should check blood glucose levels every 2-3 hours.

If patient is hypoglycaemic, take either 100ml Lucozade, 200ml of ordinary cola, 400mls ordinary lemonade or 6 glucose tablets

Withhold oral medications and insulin (if on morning dose) on day of colonoscopy

Patient to bring insulin and oral medications with them to hospital

Check blood glucose (BG) levels prior to procedure and one hour post procedure if patient is still within the department:

**Prior to colonoscopy**

- If result above 4mmol/l, it is safe to proceed with colonoscopy
- If result is below 4mmol/l, provide patient with 3 dextrose tablets or ½ glass of Lucozade
- Recheck BG level in 15 minutes and repeat as necessary until results is above 4mmol/l

**Post colonoscopy**

- If result is above 4mmol/l and patient is being provided with a breakfast, usual dose of oral medication should be taken
- If level is below 4mmol/l, follow above procedure x 1 and provide breakfast
- Recheck BG level prior to giving oral medication

NB Ensure patient's BG level is within acceptable limits (4-15mmol/l) prior to leaving the department; if any concerns contact the diabetes centre or medical staff
Advice and action to be taken for patients with Type 1 diabetes or Type 2 diabetes on twice or once daily insulin attending for colonoscopy

<table>
<thead>
<tr>
<th>Advice and Action</th>
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<tbody>
<tr>
<td>Should be advised to take Klean Prep preparation as per instructions</td>
</tr>
<tr>
<td>Patients <strong>must</strong> have a morning appointment for the procedure, otherwise it would be necessary to admit them on the day before procedure</td>
</tr>
<tr>
<td>If patient is on oral hypoglycaemics as well as insulin, please refer to advice sheet for type 2 patients on oral medications</td>
</tr>
<tr>
<td>Patient should take usual dose of morning insulin on day before colonoscopy. Patient should reduce evening dose of insulin by 50%</td>
</tr>
<tr>
<td>Patient should check blood glucose on going to bed and every 2-3 hours on awakening</td>
</tr>
<tr>
<td>Patient should be advised to take carbohydrates every 2 hours during the day. Suggested intake would be:</td>
</tr>
<tr>
<td>200ml ordinary lemonade or</td>
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<tr>
<td>100ml ordinary cola or</td>
</tr>
<tr>
<td>60ml Lucozade (original) or</td>
</tr>
<tr>
<td>100ml orange juice or</td>
</tr>
<tr>
<td>100ml ordinary squash (1/4 squash, ¾ water) or</td>
</tr>
<tr>
<td>3 glucose tablets or</td>
</tr>
<tr>
<td>3 jelly babies { not red coloured or</td>
</tr>
<tr>
<td>10 jelly beans } not red coloured</td>
</tr>
<tr>
<td>Withhold oral medications and insulin on morning of colonoscopy</td>
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<td>Patient to bring insulin and oral medications with them to hospital</td>
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<td>Check blood glucose (BG) levels prior to procedure and one hour post procedure if patient is still within the department:</td>
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</tbody>
</table>

**Prior to colonoscopy**
- If result above 4mmol/l, it is safe to proceed with colonoscopy
- If result is below 4mmol/l, provide patient with 3 dextrose tablets or ½ glass of Lucozade
- Recheck BG level in 15 minutes and repeat as necessary until results is above 4mmol/l

**Post colonoscopy**
- If result is above 4mmol/l and patient is being provided with a breakfast, usual dose of oral medication should be taken
- If level is below 4mmol/l, follow above procedure x 1 and provide breakfast
- Recheck BG level prior to giving oral medication
- Take breakfast and normal morning dose of insulin

**NB** Ensure patient’s BG level is within acceptable limits (4-15mmol/l) prior to leaving the department; if any concerns contact the diabetes centre or medical staff
Patients who require admission:

- Those who are district nurse dependent
- Those with a history of recurrent severe hypoglycaemic episodes requiring aid from another person
- Those with loss of hypoglycaemic awareness
- Those with complex medical histories including those on steroid therapy
- Those who cannot self-monitor

Patients with diabetes and acute myocardial infarction

There is some evidence that in patients with diabetes, the use of intravenous insulin to achieve tight glycaemic control at the time of MI may improve prognosis. If, in agreement with cardiologists, this is felt to be beneficial, the use of an intravenous sliding scale is suggested (see management of DKA). Alternatively, a glucose/potassium/insulin infusion can be used;
GKI INFUSION

GKI Regimen

500ml bags run 5 hourly
Prescribe on fluid chart

Check BM

<5 mmol/l
10% Dextrose + 10 mmol KCl + 6 units Actrapid

5-15 mmol/l
10% Dextrose + 10 mmol KCl + 10 units Actrapid

>15 mmol/l
10% Dextrose + 10 mmol KCl + 14 units Actrapid

Check BM after each bag

<5 mmol/l
4 units less Actrapid in next bag

5-15 mmol/l
Continue same mixture

>15 mmol/l
4 units more Actrapid in next bag

Check BM after each bag
Patients with diabetes undergoing surgery

- Desirable to admit at least 24 hours pre-op to assess control
- Inform anaesthetist and aim for morning list
- Check fasting glucose - target 4-10mmol/l [especially important if major/ vascular surgery]
  - 10-15mmol/l less desirable, if >15mmol/l contact anaesthetist
- The night before theatre, reduce OHA by 50% and long acting insulin by 30%
- On morning of theatre, omit all hypoglycaemic agents and check glucose

<table>
<thead>
<tr>
<th>Diet treated</th>
<th>Type 2 on low dose OHA</th>
<th>Type 2 on high dose OHA</th>
<th>Insulin treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor surgery</td>
<td>Minor surgery</td>
<td>Major surgery</td>
<td></td>
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</tbody>
</table>

Commence iv fluid regime
- 5% dextrose
- 10mmol KCl

- commence sliding scale or GKI regime at 0800
- if poor control introduce the preceding evening

GKI
See page 67
- Not suitable if metabolic upset (e.g., DKA)
- Less BM testing

Sliding scale
See page 69
- Use if major metabolic upset or fluid overload

Post operatively
- Continue iv insulin and fluids until normal diet resumes
- Recomence insulin / OHA before a meal and stop iv insulin one hour afterwards
- Re establish on pre-operative therapy if control was adequate
- Contact diabetes team if problems/poor control
**TYPICAL SLIDING SCALE INSULIN REGIMEN**

Add 50 units of soluble insulin (Actrapid® or Humulin S®) to 50 ml of 0.9% sodium chloride in a 50 ml syringe. Infuse IV using a pump and adjust according to sliding scale:

<table>
<thead>
<tr>
<th>Blood glucose (mmol/L)</th>
<th>Infusion Rate (units/hour)</th>
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<tbody>
<tr>
<td>&lt; 5</td>
<td>0</td>
</tr>
<tr>
<td>5.1 – 10</td>
<td>1</td>
</tr>
<tr>
<td>10.1 – 15</td>
<td>2</td>
</tr>
<tr>
<td>15.1 – 20</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 20.1</td>
<td>4 and call a doctor</td>
</tr>
</tbody>
</table>

Also see pages 35-36 for further information.
guideline for the management of diabetes in adults in palliative care

pre-terminal disease will influence glycaemic control (see box 1)

- goal of treatment is to avoid hypoglycaemia and manage symptoms of hyperglycaemia (balance against burdens of additional treatment and monitoring)
- type 1 diabetes has an absolute insulin requirement (wish to avoid diabetic ketoacidosis)

**type 1 diabetes**

- monitor BM less frequently – individualise monitoring based on patient factors and goals of care
- relax blood glucose targets (aim > 7 to <15 mmol/L as long as asymptomatic)
- **Always continue basal insulin** – patients may have reduced insulin requirement (reduce by 30 to 50%)
- Consider omitting doses of rapid acting insulin if not eating

**type 2 diabetes**

individualised treatment

consider:

- stopping or reducing oral hypoglycaemic agents (Sulfonylureas, Metformin, Pioglitazone, Gliptins)
- stopping GLP-1 analogues
- reducing pre-mix bd insulin
- consider once daily long-acting basal insulin instead (Lantus, Detemir, Insulatard)

**terminal phase**

**type 1 diabetes**

once daily basal insulin (Lantus, Detemir, Insulatard). If unsure reduce normal basal dose by 30 – 50%. Avoid dextrose containing fluids. Do not be afraid of stopping therapies at this stage.

see box 3 for communication issues.

stop monitoring

**type 2 diabetes**

stop all diabetes therapy

for persistent difficult symptoms contact local diabetes team.
Box 1  Palliative Care Considerations for Glycaemic Control

- Anorexia & Cachexia
  - Inability to take food or medicines
  - Increased hypoglycaemia risk
- Infection
- Metastatic disease
  - Increased risk of hypoglycaemia (liver, adrenals)
  - Increased risk of lactic acidosis
- Cirrhosis
  - Hypoglycaemia risk
- Tumour products
  - Most promote insulin resistance
  - Some may induce hypoglycaemia

Box 2  Drugs which may adversely affect blood glucose

- Octreotide
  - Inhibits insulin secretion, causing hyperglycaemia
- Steroids (given in the morning can cause late afternoon and evening hyperglycaemia)
  - Orexigenic (stimulates appetite), may contribute to hyperglycaemia
  (If steroids are withdrawn, reduce insulin to avoid hypoglycaemia. However, if insulin is reduced too much or stopped altogether, hyperglycaemia may result, particularly when steroids remain in the system)
- Some diuretics
- Some atypical antipsychotics may increase insulin resistance and cause hyperglycaemia

Box 3  Communications with patients and families

Patients/families who have lived with diabetes over a long period of time may find a more relaxed attitude to diet and monitoring difficult to come to terms with. It is important that the addition of insulin therapy is not seen as adding to anxiety or withdrawal perceived as abandonment of care.
### ACKNOWLEDGEMENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Reviewed by</th>
<th>Date written</th>
<th>Date of review</th>
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<tbody>
<tr>
<td>Definition of Diabetes</td>
<td>Dr M Dominiczkak</td>
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<tr>
<td>Diagnosis of Diabetes</td>
<td>Dr M Dominiczkak</td>
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<td>Structured Education</td>
<td>Dr H Hopkinson</td>
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<td>Guidelines for Diabetic Clinic Review</td>
<td>Dr S Cleland</td>
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<td></td>
<td>Dr C Perry</td>
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<td></td>
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<td>Referral of patients between primary and secondary care Diabetic Clinics</td>
<td>MCN Primary and Secondary Care Interface Group</td>
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<td>Dr M Small and Sister Heather Maxwell</td>
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<td>The management of Diabetes for people receiving enteral feeding in hospital</td>
<td>Natalie Linden</td>
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<td>Carol Anne McTear</td>
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<td>Dr C Kelly, Dr Small</td>
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<td>Dr A Gallagher</td>
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