Treatment with Insulin

Principles of Treatment

- Insulin by injection is given as replacement therapy in people with absolute or relative deficiencies in insulin secretion.
- A balance must be maintained between carbohydrate consumed, insulin administered and exercise taken - all of which can affect blood glucose concentration. The aim of treatment is to maintain near normoglycaemia.
- Self-monitoring of blood glucose and regular HbA1c measurements are necessary to ensure that treatment is effective and that targets are being met.
- Remember, all prescriptions are free for all patients on oral antidiabetic drugs (pg 32) and insulin therapy.

A trial of insulin is justified in any patient with Type 2 diabetes who is symptomatic and in whom better glucose control is likely to be associated with health gain

Generally

- Soluble (regular), short-acting insulin should be injected subcutaneously 15-30 minutes before meals
- Insulin analogues (e.g. Humalog or NovoRapid) are fast acting and can be injected immediately before eating or during or after meals.
- Insulins should be stored in a refrigerator, but not in the freezer compartment. Insulin pens in current use may be kept at room temperature.
- Diet should be reviewed for all patients starting insulin to emphasise the importance of regular meals with consistent carbohydrate content, although this will depend on individual lifestyle and the type of insulin regimen being used.
- Appropriate education on hypoglycaemia (pg 44) and diabetic ketoacidosis (DKA) (pg 75) is essential to allow effective self-management.
- Treatment needs to be individualised and must take account of things such as shift work, lifestyle, holidays, exercise, sport etc.
- Referral to a dietitian is required to allow diet to be tailored to the individual, taking into account age, lifestyle, and occupation, shift patterns, exercise etc.

Insulin should never be discontinued without prior consultation with a diabetes specialist

Aims of Insulin Treatment

- Abolition of symptoms of hyperglycaemia
- Maintenance of ideal body weight
- Avoidance of hypoglycaemia
- Maintaining as near normal blood glucose as is practical and safe for the individual.
Insulin Injection Sites and Injection Technique

Injection Sites

- The use of several different injection areas within the same site is recommended to avoid the development of lipohypertrophy.
- Insulin is absorbed more rapidly from the abdomen than from the thighs or arms, except long-acting analogues, which appear to have more uniform absorption. This should be taken into account when prescribing different insulins. Exercise accelerates the rate of insulin absorption from the injection sites on the legs, and local heat increases the rate of absorption (hot baths and showers should be avoided after injection of insulin).

Injection Technique

The technique of insulin administration should be taught by a nurse with specialist skills in diabetes.

- Check insulin type
- Check insulin dose
- Pinch up fold of skin unless using 5 or 6mm needles
- Inject needle at 90 degrees into this fold; avoid lumpy and hypertrophied areas
- Dispose of syringe and/or needle carefully. *See appendix 7 (pg 107)

There is no need to swab the skin before or after insulin injection

Commonly Used Insulin Preparations

There are three main types of insulin preparations.

Short Acting Insulin

Those of short duration that have relatively rapid onset of action are called soluble insulins. The traditional soluble insulins include Humulin S. For those patients who require animal insulin there are pork insulin preparations such as Hypurin Porcine, Neutral and a beef insulin preparation called Hypurin Bovine Neutral.

Fast Acting Insulin

Fast-acting insulin analogues (Humalog (insulin Lispro), NovoRapid (insulin Aspart) and Apidra (insulin Glulisine)) are available which have a more rapid onset and a shorter duration of action than the soluble insulins. They can be injected immediately before during or after meals.

Intermediate Insulin

Insulins with an intermediate time-action are called Isophane (or NPH) insulins and include Insulatard and Humulin I. For those patients who prefer animal insulins there is Porcine and Bovine Hypurin Isophane.

Long Acting Insulin

Long-acting analogue insulins are available called Lantus (insulin Glargine) and Levemir (insulin Detemir), which have a duration of action of up to 24 hours.

Insulin Mixtures

Fixed mixtures of insulin are available which contain Soluble and Isophane insulins in varying proportions, e.g. Humulin M3, Hypurin Porcine 30/70 Mix. In addition there are fixed mixtures of analogues such as Humalog Mix 25, Humalog Mix 50 and NovoMix 30.
Insulin Administration Devices and Blood Glucose Monitoring Equipment

**Pen Injection Devices**

Many patients use an injector device for insulin administration. This is available in two forms, either a reusable form for use with a cartridge or a pre-filled (disposable) type. The principal advantage of injection devices is the convenience of carrying and administering the insulin.

Disposable (pre-filled) devices are particularly useful for patients with limited dexterity and visual impairment. Pre-filled pens are available on prescription.

Some Re-usable Pens are available from Diabetes Clinics or can be provided on prescription and are free to patients. Cartridges containing insulin are mostly 3ml in volume and are obtained on prescription. All insulin cartridges and pre-filled pens are now 3 ml and can be obtained on prescription.

Pen needles are available on prescription. 8mm, 6mm and 5mm lengths are used most commonly.

Re-use of Needles is not recommended. **Pen injection devices are for use by patients only and should not be used by other health care staff because of the risk of needle stick injury when re-sheathing.**

**Syringes**

Plastic syringes may still be the preferred method of delivery for some patients e.g. those using two different insulin preparations simultaneously that require free mixing of insulin, or those patients using large volumes of insulin which cannot be administered with a pen device. Syringes with attached needles are obtained on prescription, and are available in 30, 50 and 100 unit sizes.

Syringes are available for use with 12.7mm length and 8mm length needles however **use of 12.7mm needles is not recommended for people with diabetes.**

**Glucose Monitoring Equipment**

A wide variety of blood glucose meters are available but electrodes (test strips) are not interchangeable for use between the various brands. Contact any of the Diabetes Specialist Nurses for further details and advice.

**Disposal of Sharps**

See Appendix 7 (page 107)

**Insulin Regimens and Dosage Adjustment**

**Principles of Dosage Adjustment**

No single solution applies to all situations. Many patients are capable of becoming skilled at self-adjustment of their insulin dose and regimen. Other than fast acting analogues, insulin is not normally adjusted on the basis of a single blood glucose reading. Check monitoring technique/injection technique.

- Identify the periods of day in which problems are occurring with glycaemic control and look for a pattern in blood glucose readings
- Be alert to blood glucose values that are out of keeping with the HbA1c concentration.
- Review insulin dose distribution.
- Review eating patterns including alcohol consumption.
- Review whether poor control in one part of the day reflects previous activities.
- Consider an adjustment of dose by 10% initially.

**Dose adjustment**
To adjust insulin doses for a twice daily fixed insulin mixture (eg novomix 30 / mixtard 30):
• If glucose high/low before breakfast, increase/decrease **EVENING** insulin dose
• If glucose high/low before evening meal, increase/decrease **MORNING** insulin dose

For dosage adjustment with a basal-bolus regimen (eg novorapid / humalog and insulatard / levemir / lantus):
• 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 evening meal, increase/decrease **LUNCHTIME** short-acting insulin
• If glucose high/low before bed, increase/decrease **EVENING** short-acting insulin

Other adjustments may necessitate a change of the mixture. For further advice please contact the Diabetes Team (Diabetes SPR or Diabetes Specialist Nurse) via switchboard.

**Too much insulin**

The following symptoms are suggestive of over-insulinisation:
• Recurrent Hypoglycaemia
• Wide excursions of blood glucose
• Weight gain
• Subtle features of chronic hypoglycaemia
  - Headache
  - Craving to eat
  - Personality change in the older person

**Too Little Insulin**

The following symptoms are suggestive of too little insulin:
• Chronic hyperglycaemia/osmotic symptoms
• Weight loss
• Feeling non-specifically unwell
• Nocturia, nocturnal thirst
• Chronic fatigue (“hyperglycaemic malaise”)
• Mood change (depression)
• Urinary incontinence

**Insulin in the Older Person**

Age itself is not a contraindication to insulin therapy
• Targets for glycaemic control in the elderly may not need to be as strict as in the younger patient. A target HbA1c of <7.5% (59 mmol/mol) may be inappropriate.
• The aims of treatment are to control hyperglycaemia with particular avoidance of hypoglycaemia.
• It may be necessary to avoid the use of short-acting insulins in the very elderly. Regimens using twice daily isophane or once daily long-acting insulin analogue are often effective in this age group, and have a lower risk of hypoglycaemia.