MIL

Oxford University Hospitals NHS Trust

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This Medicines Information Leaflet is produced locally to optimise the use of medicines by encouraging prescribing that is safe, clinically appropriate and cost-effective to the NHS.

Safe initiation, administration, and titration of subcutaneous insulin in adult patients with diabetes

The aim of this MIL is to provide practical guidance on initiation, administration, and titration of subcutaneous (sc) insulin in adult patients with diabetes mellitus (DM).

Insulin is available in various strengths (number of units per ml) and preparations based on the duration of action (rapid, short, intermediate, mixed and long acting). There are several different administering devices e.g. vials, pre-filled pens, insulin pumps. This increases the risk for potential medication errors.

Improvements in insulin safety can always be made. Errors occur due to several factors e.g. unfamiliarity of insulin names and profile of actions as well as problems with similar sounding insulin names resulting in prescribing, dispensing and administration errors.

Safe Prescribing – General principles

- Insulin must always be prescribed by 'BRAND' name (e.g. Semglee® instead of glargine).
- Free text prescribing should **not** be used.
- Select the correct insulin AND device on ePMA
- If the patient has not brought insulin or their insulin device from home or you are unsure what device the patient uses, then prescribe a **pre-filled pen.**
- Insulin on EPR is prescribed in UNITS. Any dose of insulin must be documented in 'UNITS' in full (U or IU should **never** be used in any documentation).
- Take care when prescribing *sound alike* insulin names to ensure you have selected the correct insulin on EPMA. To avoid these errors type out the full name e.g. confusion between Humulin I® or Humulin M3®.
- Some insulin preparations are now available in **strengths** other than 100units/ml (e.g. Tresiba® Flextouch 200 units/ml, Toujeo® Solostar/Doublestar 300 units/ml). Extra care should be taken when prescribing.
- Do not continue an insulin from a patient's medication history on EPMA without first confirming with the patient that they are still on the insulin being prescribed.

Finding information on insulin type or dose

- **Ask the patient or contact a relative or next of kin**.
- Review Health Information Exchange for details of insulin type (will not give dose).
- Contact carers or district nurse if they routinely administer insulin in the community.
- Liaise with ward pharmacist to establish the current insulin doses

If unable to obtain details on type and dose of insulin, use following regimen until further information is available:

Give a total daily dose of 0.3units of insulin per kg body weight e.g. 0.3x70kg = 21units

- 21units should be administered as a basal insulin e.g. Semglee® once a day
- PRN Trurapi® should be given with meals with glucose is out of range (6-10mmol/L)
- Aim to find out regular medication and review dose.

NEVER omit a basal (long acting) insulin dose in patients with type 1 diabetes.

Monitoring and dose titration

Inpatients on subcutaneous insulin should have their capillary blood glucose (CBG) monitored **at least four times a day** (before meals and before bed).

If CBG is **persistently** above target in the **morning** (usually 4-12mmol/L).

→ Increase basal insulin by 10% every 2 days. If on intermediate insulin e.g. Humulin I® increase evening dose as above. Adjust doses by 10% every 2 days until CBG in range.

If CBG is above target (usually 4-12mmol/L) **before lunch, dinner or bedtime**

→ Increase the rapid/short acting insulin e.g.Trurapi®, NovoRapid®, Humalog® at the **meal before the rise** of CBG. Adjust doses by 10% every 2 days until CBG in range. E.g. if pre-dinner CBG is 15mmol/L then increase lunchtime rapid / short acting insulin by 10%.

Capillary blood ketones should be checked if CBG above 12 mmol/L.

- **Ketones equal to or more than 3mmol/L**, check pH or bicarbonate and start DKA protocol if in DKA.
- **Ketones 1 - 2.9 mmol/L** ensure adequate hydration and consider additional correctional dose of subcutaneous Trurapi®. This should not be repeated within 2 hours of previous Trurapi® insulin dose.
- **Ketones less than 1 mmol/L**, consider a 10% increase in regular insulin dose.

Corrective Dose

- If a patient fulfils the criteria for a single correction dose of insulin then use subcutaneous Trurapi® (or patient's own rapid-acting insulin instead of Trurapi®). Dose according to patient's CBG as table below (or patient's own correction dosing where applicable).

Subcutaneous Insulin Correction Dose Table	
CBG (mmol/L)	Insulin units
12 – 14.9	1
15 – 17.9	2
18 – 20.9	3
21 – 23.9	4
24 – 27	5
Above 27	6 Rule out DKA/HHS. Contact diabetes team for advice if needed.

- Consider giving a single dose of 1-6 units Trurapi® as per table. Check CBG after 2 and 4 hours. If at 4 hours, CBG remains > 18 mmol/l - doctor to review PRN insulin dose. Consider giving second PRN dose. If after 2 consecutive PRN insulin doses, CBG remains >18 mmol/l, doctor to re-assess patient, and consider transfer to IV variable rate insulin (VRIII). **If you use PRN doses of insulin to reduce high CBG, you must also review the usual diabetes treatment**
- If giving single rapid acting insulin especially at night to monitor glucose levels at 2 and 4hrs. There is a risk of hypoglycaemia as patients are more sensitive to insulin at this time.
- If patient experiences hypoglycaemia overnight following a correction dose, continue to give patient their regular dose of insulin the following morning.
- If correction dose insulin is used, the patient's usual diabetes regimen should be reviewed. Consider increasing the usual insulin dose before the rise in blood glucose by 10%.
- Single doses of corrective Trurapi® insulin must not be continued on discharge, unless the patient is going to a community hospital, where it may be continued if appropriate.

Delay in administration of Long-Acting insulin

- If a long-acting insulin dose (Tresiba®, Toujeo®, Lantus®, Abasaglar®) is delayed [or missed] (we don't want to accept missed doses in hospital but they may have missed it prior to admission), administer as soon as practical. do not double the next dose. Increase frequency of glucose monitoring (every 2-4hrly for 24hours), and check ketones if glucose rises above 15 mmol/l. Seek specialist diabetes advice if there is uncertainty regarding dose adjustment or persistent hyperglycaemia. **Do not double the next dose**

Insulin Therapeutic substitution

If a patient does not have their own insulin with them and it is unavailable from pharmacy in the correct device, then an

insulin from the same group can be prescribed temporarily e.g. prescribed Semglee® if patient does not have Lantus® or Abasaglar® (see **Insulin Profiles below)**. Contact pharmacy promptly to ensure timely supply of the insulin.

Administering insulin

All insulin must be independently (double) checked as part of nurse administration. This must be documented on the prescription (use "witnessed by" option in ePMA). The patient/carer can be one party.

Patients should be encouraged to self-administer insulin under supervision of a nurse.

If a patient has brought in their own supply of insulin, ensure this matches the insulin prescribed. Alert the prescriber to any discrepancies.

If patients are on Insulin pump (CSII) then please refer to Inpatient DSN team.

Insulin syringes

- Insulin must **ONLY** be given using an insulin syringe (from a vial), insulin pen device (cartridge with a reusable pen or prefilled pen) or continuous subcutaneous insulin infusion (CSII or insulin pump).
- Intravenous syringes must **NEVER** be used to give insulin
- Insulin **MUST** only be withdrawn into an insulin syringe from a vial. Insulin should **NEVER** be withdrawn from a cartridge or pen device.
- Insulin syringes should be stored alongside insulin vials in the fridge

Diabetes team referral

- Refer to diabetes team via Requests & Prescribing on EPR if starting insulin in a patient previously on oral agents
- Diabetes Specialist Nursing team can be contacted in hours via Requests & Prescribing on EPR only
- Diabetes/Endocrine registrar can be contacted via switchboard 24hrs a day.

Separate guidelines for the use of insulin in adults are available in the following MILs:

1. Diabetes – management before, during & after operations & procedures
2. Diabetic Ketoacidosis (DKA) management
3. Hyperosmolar Hyperglycaemic State (HHS) management
4. Insulin – intravenous infusions
5. Hyperkalaemia - management

References:

1. NHS *National Diabetes Inpatient Audit (NaDIA) - 2019*. NHS Digital, 2020. https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-audit/2019
2. Joint British Diabetes Societies for Inpatient Care. Diabetes at the Front Door Revised May 2023 JBDS_16_Diabetes_at_the_Front_Door_Guideline_with_QR_code_May_2023.pdf
3. Joint British Diabetes Societies for Inpatient Care. Inpatient Care of the Frail Older Adult with Diabetes. JBDS_15_Inpatient_Care_of_the_Frail_Older_Adult_with_Diabetes_with_QR_code_February_2023.pdf

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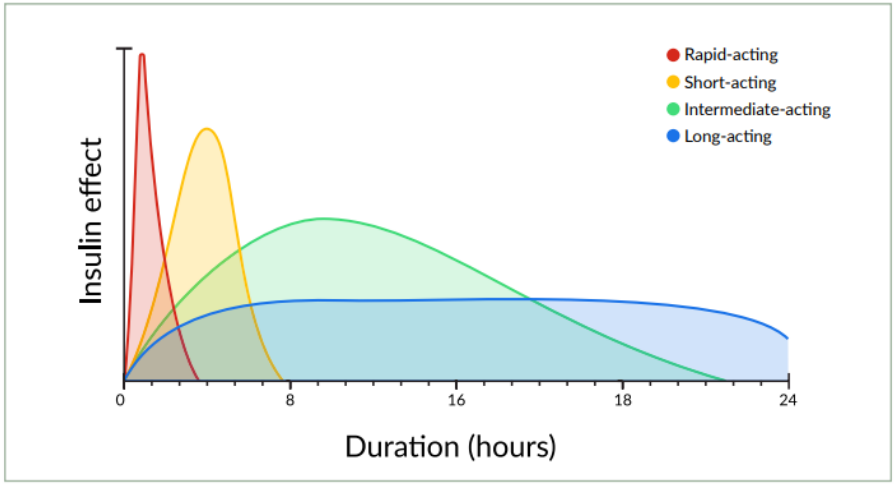
Insulin Profiles

This is a guide to the types of insulin. It includes details around the effects of each insulin, as well as practical advice on how each type of insulin can be given (Table 1). Insulin is broadly divided into: rapid acting, short acting, intermediate acting and long acting.



Insulin Device	Method of administration
Vial	Use insulin syringe (in clinical areas, store in fridge with insulin vial)
Pre-filled pen device	Use prefilled pen device
Cartridges	Via specific pen device (see table below) **If the patient has not brought their reusable pen device, prescribe & supply the insulin in a pre-filled pen device***

**Except for Tresiba®, which is only available in cartridges (the Novopen® device can be supplied by Pharmacy)*

The table below shows the different insulins available at OUH according to their duration of action. It also contains details about device availability, insulin time action profile and typical dosing schedules.

BRAND name to be used when prescribing insulin	Available in the following devices	Approximate time action profile	Administration and Typical dosing schedules
Rapid Acting Insulin			
Trurapi® (aspart)	Vial Cartridge via Novopen® pen device SoloSTAR® prefilled pen	**Onset:** 10-20 minutes **Peak**: 1 hour **Duration**: up to 4 hours	**Give just before/with/just after food.** Usually three times a day subcutaneously (s/c) give 10- 20 minutes before food
NovoRapid® (aspart)	Vial Cartridge via Novopen® pen device 1.6mL cartridge (for Accu-Chek SC Pump) FlexPen® prefilled pen		**Corrective rate for hyperglycaemia:** Can be given 4 hourly to correct out of range glucose. Can also be given to help clear excess ketones.
Humalog® (lispro)	Vial Cartridge via Humapen® pen device KwikPen® prefilled pen		
Fiasp® (aspart)	Vial Cartridge FlexTouch® prefilled pen	**Onset:** 1.5-5 minutes **Peak**: 45 minutes **Duration**: 3-5 hours	**Give up to 2 minutes before or up to 20minutes after starting a meal.**

BRAND name to be used when prescribing insulin	Available in the following devices	Approximate time action profile	Administration and Typical dosing schedules
Short Acting Insulin			
Humulin S® (Soluble)	Cartridge via Humapen® pen device	**Onset**: 30 minutes **Peak:** 1-3 hours **Duration**: up to 8 hours	**Give 20-30 minutes before food.** Usually three times a day S/C, 30 minutes before food. **Corrective rate:** 4 hourly
Mixed Insulin: Short and Long Acting Insulin			
NovoMix 30® (biphasic aspart)	Cartridge via Novopen® pen device FlexPen prefilled pen	**Onset:** 10-20 minutes **Peak:** Dual **Duration:** up to 24 hours	**Give just before/with/just after food.** Twice daily S/C. These insulins require re-suspending (roll between palms and turn up and down) before use. (NOTE: The number after the name of the insulin refers to the percentage of rapid acting insulin).
Humalog Mix 25® (biphasic lispro)	Cartridge via Humapen® pen device KwikPens® prefilled pen		
Humalog Mix 50® (biphasic lispro)	Cartridge via Humapen® pen device KwikPens® prefilled pen		
Humuli M3® (30% short-acting soluble and 70% intermediate acting isophane)	Cartridge via Humapen® pen device KwikPens® prefilled pen	**Onset:** 30 minutes **Peak**: 2-8 hours **Duration**: up to 24 hours	**Normally given twice daily.** This insulin requires re-suspending (roll between palms and turn up and down) before use.

BRAND name to be used when prescribing insulin	Available in the following devices	Approximate time action profile	Administration and Typical dosing schedules
Intermediate Acting Insulin			
Humulin I® (isophane)	Cartridge via Humapen® pen device KwikPens® prefilled pen	**Onset**: 1.5 hours **Peak**: 4-12 hours **Duration**: up to 24 hours	**Normally given once or twice daily.** requires re-suspending before use
Long Acting Insulin			
Semglee® (glargine)	Prefilled Pen	**Onset:** 24-48 hours **Peak:** extended activity **Duration**: up to 24 hours	**Give once or twice daily.** Must be given at the same time each day.
Lantus® (glargine)	Vial SoloStar® prefilled pen Cartridge via AllStar PRO or JuniorSTAR pen device		
Levemir® (detemir) *due to be discontinued end Dec 2026, not to be started.	Vial FlexPen prefilled pen Cartridge via Novopen® pen device		
Abasaglar® (glargine)	KwikPen prefilled pen Cartridge via Humapen® pen device		
Toujeo® (glargine – 300units/mL)	SoloStar® prefilled pen	**Onset:** 24-48 hours **Peak:** extended activity **Duration:** up to 72 hours	

Tresiba® (degludec 100units/mL) **200 units/mL available BUT NOT stocked at OUH – prescribe <u>same number</u> of units of the 100units/mL formulation.**	Cartridge via Novopen® pen device	**Give once daily.** Tresiba® allows for flexibility in the timing of insulin administration when administration at the same time of day is not possible.	
Pre-Filled insulin – Variable Rate Intravenous Insulin Infusion/Fixed Rate Insulin Infusion			
Human Soluble Insulin 50units in 50mL prefilled syringe	Prefilled syringe (unlicensed product)	**Onset:** near instant **Duration:** less than 1 hour post infusion.	Give as per guidance including Variable RIII MIL MILV6N7 and DKA MIL. MILV4N9

Reference: Insulin Types. Accessed via https://diabetesmyway.nhs.uk/media/7563/insulin-types-v2.pdf