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Medicines Management

Insulin safety

Study guide

Medicines management

Insulin safety

Background

One in six people in a hospital bed has a diagnosis of diabetes mellitus. A significant number are insulin treated. Patient safety incidents involving insulin are common: 40% of people with Type 1 diabetes and 37% of insulin-treated type 2 diabetes experienced an insulin error during inpatient admission in the UK (NaDIA 2017).

Insulin errors can lead to hypoglycaemia or hyperglycaemia which may result in:

- An increased length of hospital stay
- Poor patient satisfaction
- Reduced confidence in hospital care
- Increased risk of infections and further complications
- Diabetic Ketoacidosis (DKA)
- In extreme cases, even death

Insulin Safety Video

Insulin errors are preventable. Please watch this brief video on insulin safety to see how you maybe able to help with prevention: https://www.cdep.org.uk/insulin-safety.html

Types of Insulin

There are different types of insulin available and they are classified according to how quickly they start working and how long they last in the body. All clinical staff should have a broad understanding to ensure safe use of insulin in hospital:

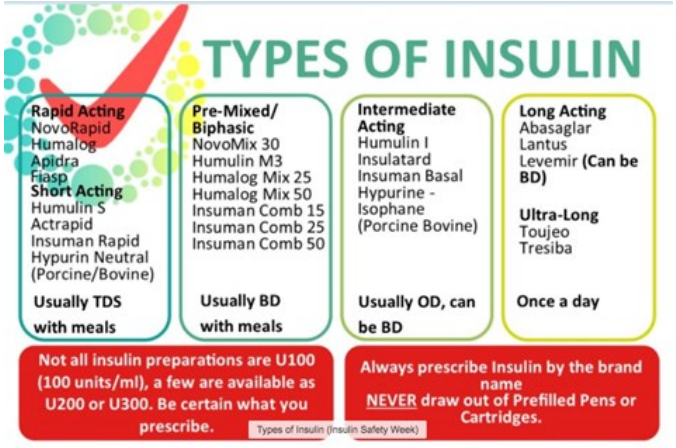

Figure 1: Types of insulin

Safe Use of Variable Rate Insulin Infusions (VRIII)

The majority of patients who are eating and drinking normally, may have their diabetes successfully managed with adjustment or maintenance of their pre-existing diabetes treatment. In certain cases, a variable rate intravenous insulin infusion (VRIII, previously known as a 'sliding scale') may be indicated. Examples are below:

- Hyperglycaemia and unable to take oral food/fluid
- Nil by mouth (NBM) and missing more than 1 meal
- Type 1 diabetes and NBM
- Severely ill with need to achieve good glycaemic control (eg: sepsis)
- Treatment of Diabetic Ketoacidosis (after fixed rate infusion)

When used appropriately, VRIII has been shown to improve patient outcomes. When used incorrectly however, it can cause severe hypo or hyperglycaemia. Key points in the safe use of VRIII include:

- Ensure a clear indication to start VRIII and review daily the need to continue.
- Hourly capillary glucose checks (CBG) are essential
- Long acting insulin should be continued alongside VRIII to avoid rebound hyperglycaemia/ ketosis
- All other diabetes medications should be discontinued whilst on VRIII
- **Long-acting insulin should never be withheld in people with type 1 diabetes even when they are treated with VRIII as this may precipitate DKA**
- VRIII should be reviewed frequently with regular adjustments made according to local protocols. The inpatient diabetes team should be contacted if glucose levels are not responding to VRIII treatment
- Hypoglycaemia on VRIII should be treated according to the trust guideline and VRIII restarted within 20 mins of successful treatment

  The VRIII should only be discontinued 30 minutes after subcutaneous insulin has been given ideally at meal time.

- For non-insulin treated diabetes patients, give the usual treatment prior to discontinuing VRIII and seek advice from the diabetes team if control prior to admission was suboptimal
- If CBG rises after the VRIII is discontinued, contact the diabetes team – do not restart the infusion
- Check CBG one hour after discontinuing VRIII, at least four-hourly for the first 24 h after VRIII has been discontinued, and 2–4 times daily for all inpatients on subcutaneous insulin

Self-Management

Self-management of diabetes is the process of deciding on and administering an insulin dose in response to self-measured capillary glucose values. Self-administration is the taking of medication (injected or oral) as prescribed.

Many people with insulin-treated diabetes self-manage their diabetes when out of hospital, checking their CBG and adjusting insulin dose accordingly. These patients should be given the choice to continue to self-manage during admission unless there is a specific reason why they can not. Self-management of diabetes by patients who are willing and able is an important part of the strategy to improve the safety of insulin use in hospital.

The Trust policy on self-management of diabetes may be found on We Share Exclusion criteria to self-management include:

- Patients who prefer their diabetes to be managed by the healthcare team during their admission
- Patients at risk of self-harm
- Patients deemed unable to participate due to lack of capacity as defined under the Mental Capacity Act (2005)
- Patients admitted as a result of poor glycaemic control (until assessed by the diabetes specialist team)
- Patients who will not be self-medicating on discharge

It is important that self-management is reviewed if the patient's condition deteriorates (eg they become more confused, unwell or increasingly dependent) or if an insulin-related self-management incident occurs. Self-management decisions should also be reviewed if patients are to receive treatment that might impact on diabetes control and is outside of their experience (e.g. steroid treatment).

Further information

The diabetes inpatient management at a glance (figure 2) as well as the patient safety alert (figure 3) have been widely distributed in clinical areas to provide more information on insulin safety. Related trust guidelines on diabetes management are available on the Trust intranet. Your local inpatient diabetes team maybe contacted through electronic referral form on Cerner or through usual local referral routes

IMPORTANT

DIABETES IN-PATIENT MANAGEMENT AT A GLANCE

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Insulin : NEVER OMIT LONG ACTING e.g. Lantus (glargine), Levemir, Abasaglar, Toujeo and Tresiba (Degludec) OR INTERMEDIATE ACTING INSULIN e.g. Humulin I, Insuman basal and Insulatard. Continue while on insulin infusion and NBM unless indicated otherwise

Ketones: Check blood ketones if CBG > 14mmol/L. If blood ketones >1.0mmol/L: Inform medical or Diabetes specialist team

Steroids: Check CBG once daily when patients are on steroids (e.g. Prednisolone, Dexamethasone, Hydrocortisone)

Check CGB either 2 hours post lunch OR before dinner. If CBG >12 mmol/L, monitor more frequently (before breakfast, lunch and dinner). If CBG persists above 12 mmol/L, contact the medical or Diabetes specialist team.

HYPOGLYCAEMIA <4.0 mmol/L

Conscious	Unconscious
Give 15-20g quick acting carbohydrate of the patient's choice where possible • 5-7 Dextrosol® tablets or 4-5 Glucotabs® • 3-4 heaped teaspoons of sugar dissolved in water **(not milk)**	**Seek medical assistance** If IV access available, give20% IV dextrose 75-100 ml over 15 minutes **OR** 150-200ml of 10% glucose (over 15 minutes If no IV access then give 1mg glucagon IM(once only).
Recheck BG after 10-15 minutes	Recheck BG every 10 minutes until ≥ 4.0 mmol/L- Repeat the treatment if required.
If it is still less than 4.0mmol/L, repeat step 1 (no more than 3 treatments in total)	When patient regains consciousness, administer a long acting carbohydrate
If patient's condition does not improve after 3 cycles of administering Quick acting Glucose contact doctor. Consider IM Glucagon 1mg or 150-200ml of 10% glucose over 15 minutes . Once blood glucose is above 4.0mmol/L and the patient has recovered, give a long acting carbohydrate of the patient's choice where possible. E.g. 2 biscuits or 1 slice of bread. **Monitor and document capillary blood glucose regularly for at least 24 to 48 hours.**	Once blood glucose is above 4.0mmol/L and the patient has recovered, give a long acting carbohydrate of the patient's choice where possible. E.g. 2 biscuits or 1 slice of bread. **Monitor and document capillary blood glucose regularly for at least 24 to 48 hours.**

HYPERGLYCAEMIA >14 mmol/L

Check for ketones

If Ketones above 1.0mmol

Check VBG

Avoid PRN Actrapid

Inform Diabetes team

NEVER WITHDRAW INSULIN FROM THE PEN

Switch off insulin infusion only 30minutes after giving the routine S/C insulin

Regular foot check documentation is important in all patients with diabetes.

Seek help from the diabetes team whenever required

Hyperglycaemic Hyperosmolar Syndrome (HHS)

CRITERIA:

- **High Osmolality** (2Na + glucose + urea) mosm/kg: consider above 320
- **High Blood Glucose**: > 30 mmol/L
- **Hypovolaemia**

THERAPEUTIC MANAGEMENT

Aim: To normalise the osmolality, replace fluid and electrolyte losses and normalise blood glucose

- Use intravenous (IV) **0.9% sodium chloride solution** as the principle fluid. (An initial rise in sodium is expected and is not itself an indication for hypotonic fluids. The rate of fall of plasma sodium should be no more than 10 mmol/L in 24 hours)
- Assess for complications of treatment every 1-2 hours e.g. fluid overload or cerebral oedema (as indicated by a deteriorating conscious level)
- Do not start insulin infusion until BG has ceased falling with fluid resuscitation. If still blood ketones > 3 start insulin at 1 – 2 units/hr. Fall in CBG should be no more than 5 mmol/L/hr. Aim to keep CBG in between 10-15mmol.

DIABETES SPECIALIST TEAM

Nurses: **Bleep 1286/1444/1287/1446/1434**
Bhnt.rlh_diabetes@nhs.net

Diabetes/Endocrine registrar: **Bleep 1585**

Diabetic Ketoacidosis (DKA)

DKA is a medical emergency with a significant morbidity and mortality.

Involve the diabetes specialist team at the earliest possible stage.

Patient on SGLT2s e.g. Dapa/Empa/Canagliflozins are at risk of DKA

CRITERIA:

- **Ketonaemia** > 3.0mmol/L **or** significant **ketonuria** 2+ or more
- **Blood glucose** > 11.0mmol/L OR on Insulin
- **Bicarbonate** (HCO3-) < 15.0mmol/L **and/or** venous pH < 7.3

THERAPEUTIC MANAGEMENT

Aim: To Restore circulatory volume, clear acidosis and body of ketones also correct electrolyte imbalance

- Commence IV 0.9% sodium chloride solution as per protocol
- Commence a Fixed Rate Intravenous Insulin Infusion and continue until acidosis and ketosis corrected.
- Monitor hourly blood glucose (BG) and hourly ketone measurement, with at least 2 hourly serum potassium and bicarbonate for the first six hours
- Keep CBG 14mmol or above until ketosis corrected by giving 10% Dextrose on separate line.
- Start /continue long acting insulin daily

Adapted from JBDS guidelines: https://abcd.care/joint-british-diabetes-societies-jbds-inpatient-care-group

Version 1: 30th January, 2020

Figure 2: Diabetes inpatient management at a glance Barts Health NHS Trust

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MEDICATION SAFETY ALERT

Risk of severe harm and death due to omission of long acting insulin

Over the last 6-months, there has been 2 reports of serious patient's harm due **to omission or delay in the administration of long acting insulin**. In both incidents, the patients (with type 1 diabetes) did not have their long acting insulin administered for a period of time leading to diabetic ketoacidosis (DKA) and significant patient's harm.

Who is this safety alert aimed at?

All staff involved in the management of adults with diabetes.

What do they need to be aware of?

- Never **OMIT or DELAY** long acting insulin particularly in a patients with Type 1 diabetes.
- **DO NOT OMIT long acting insulin** if the patient has hypoglycaemia before bedtime dose. Treat hypoglycaemia and give insulin, **but the patient should have a bedtime snack and dose may need adjustment.**
- **Never DISCONTINUE** sliding scale insulin in patients with type 1 diabetes unless the patient has started their routine insulin regime.
- Not all insulins are 100units/ml, some new insulins are **double/triple** the concentration of traditional insulins (see examples below).

Insulin Glargine **300units/ml**

Insulin Degludec **200units/ml**

Insulin Glargine **100units/ml**

Actions

Prescribers

- Ensure patients are prescribed their long acting insulin on admission.
- Prescribe insulin by brand name.
- **Prescribe doses in UNITS**
- Prescribe a bedtime snack e.g. biscuit on the regular side of the drug chart for all patients on insulins or sulphonylurea e.g. gliclazide.

Nurses and Midwives

- Where feasible and safe, help patients to self-administer insulin.
- Ensure all administered doses (including self-administered doses) are clearly documented.
- For patients who have had a hypoglycaemia episode, give bedtime snack and **perform 2am capillary blood glucose reading.**
- **Ensure persistent hypoglycaemia or hyperglycaemia are escalated to the medical/ diabetic team.**
- Contact the ward/on-call pharmacist if the required insulin is unavailable or seek a review from the medical/diabetic team.
- Concentrated insulins e.g. Toujeo (300 units / ml) should always be with the patient at the bedside and **NEVER** kept in the fridge.

Ward Pharmacy Team

- Ensure non-ward stock of long acting insulins e.g. **Lantus, Levemir, Toujeo and Tresiba** are dispensed and available on the ward in time for the required dose.
- Ensure persistent hypoglycaemia or hyperglycaemia are escalated to the medical team.

Pharmacy Governance and Safety Team July 2019. Approved by the Trust Medicines Safety Committee and the Trust Insulin Safety Group

Figure 3: Patient safety alert poster, Barts Health NHS Trust

References

- National Diabetes Inpatient Audit (NaDIA) 2017
- Cambridge Diabetes Education Programme (various sections adapted from online training for study guide as well as test questions): https://www.cdep.org.uk/home.html and safe use of insulin module: https://www.cdep.org.uk/safe-use-of-insulin-in-hospital.html
- e-learning for healthcare, safe use of insulin: https://www.e-lfh.org.uk/programmes/safe-use-of-insulin/
- Insulin safety week resources (Types of insulin, figure 1): https://insulinsafetyweek.com/
- Barts Health DATIX report for diabetes-related incidents
- Joint British Diabetes Societies for Inpatient Care Group. Self-management of diabetes in hospital. March 2012: https://www.cdep.org.uk/questionDocs/13363/Self-management-in-hospital.pdf
- Leicester Diabetes Centre, Eden. Handbook for adult inpatient diabetes care: https://www.inpatientdiabetes.org.uk/
- NICE Key therapeutic topic 2017. Safer insulin prescribing: https://www.nice.org.uk/advice/ktt20/resources/safer-insulin-prescribing-pdf-58758006482629
- Inpatient diabetes education through animation IDEA. Insulin safety, safe use of VRIII: https://www.youtube.com/watch?v=wjjEt00KOTc&list=PLY9fm3n9gbkmHb4yd4H3ifUXpPVwKZv4v&index=11&t=0s
- George S, Dale J, Stanisstreet D on behalf of the Joint British Diabetes Societies for Inpatient Care and the Joint British Diabetes Societies Medical VRIII writing group. A guideline for the use of variable rate intravenous insulin infusion (VRIII) in medical inpatients. Br J Diabetes Vasc Dis 2015;15:82-85

  https://bjd-abcd.com/index.php/bjd/article/viewFile/73/159