Statewide Quality Branch

Quality Use of Medicines Program

Endorsed by the
Victorian Medicines Advisory Committee (VMAC)

Quality use of medicines **alert**

SUBCUTANEOUS INSULIN

Attention	Chief executive officers, directors of medical services, doctors, nurses and pharmacists		
Alert	**SUBCUTANEOUS INSULIN can be FATAL or cause SERIOUS HARM if administered inappropriately.**		
Date	December 2008	**Issue**	Vol.1. No.2
Further information	www.health.vic.gov.au/vmac		

Case studies

How communication of insulin orders can cause significant harm or death.

An Australian case example

A patient with diabetes had been admitted to a hospital for stabilisation of a cardiac condition. On the third day of admission, the nurse read 90 as the number of units on the medication chart for the patient's insulin dose and administered the dose. The doctor had in fact written 9U on the chart instead of 9 units. The dose resulted in the patient requiring urgent medical attention and admission to the hospital's intensive care unit for further treatment and stabilisation.

The patient was very traumatised, and her stay in hospital became long and complicated when it should have been a straight forward admission. [2]

Introduction

Critical incidents have occurred during the prescription and administration of subcutaneous insulin.

Errors

- Incorrect dose prescribed.
- Incorrect insulin formulation prescribed.
- Incorrect insulin formulation selected and administered.
- Incorrect dose administered.
- Prescribed dose misinterpreted and incorrect dose administered.

Contributing factors

- Using the non-approved abbreviation 'U' for units. Doses prescribed using the abbreviation 'U' for units has led to staff misinterpreting the 'U' as a 'zero' and resulted in a ten-fold increase in the dose administered.
- Insulin product names can be confusing and be misinterpreted. For example, names that include numbers, such as 'NovoMix 30' can be misinterpreted and the '30' mistaken for the dose leading to an incorrect dose being administered.
- Insulin formulations, or their labels and packaging, may look alike and sound alike, for example Humalog and Humalog Mix 25.
- Large and variable dose ranges may mean that errors are less easily detected. For example, a large dose which is safe in one patient may be harmful in another.
- Ambiguous prescriptions or unusually large doses may not be queried prior to administration.

Recommendations

1. Actively increase awareness of insulin as a high risk medicine in your organisation. For definitions and further examples of high risk medicines see the link at: www.health.vic.gov.au/vmac/projects/hrm.htm
2. Ensure the dose measure 'Units' is always written in full. A prescription using the error-prone abbreviation 'U' should be considered inaccurate and should be questioned then re-written by the prescriber. If the prescriber does not respond appropriately to this query, consider a process to escalate the concern. Consider a separate prescription order form for insulin with 'Units' pre-printed.
3. Ensure policies and culture support staff who question unclear or potentially hazardous medication orders.
4. Develop blood glucose monitoring guidelines and a process for reviewing the results to ensure insulin therapy is managed optimally.
   - Review blood glucose level (BGL) monitoring and documentation processes.
   - Include hypoglycaemia management, management of insulin overdose and use of agents to treat hypoglycaemia such as glucose gel, glucagon and intravenous glucose (dextrose).

SUBCUTANEOUS INSULIN

Case studies

How communication of insulin orders can cause significant harm or death.

Overseas case examples

A patient died when 20 units of insulin was abbreviated as 20U. The U was mistaken for a zero and the patient was administered 200 units.[3]

An order for insulin glargine led to a massive overdose for a diabetic patient. The nurse transcribed a verbal order as 10 units. The nurse read the order back and the prescriber changed the order to 8 units. The nurse crossed the 10 out and wrote 8 next to it on the same line. The cross out was not clear and the dose was interpreted as 108 units and administered. The error was discovered when the patient developed significant hypoglycaemia. Fortunately, no permanent harm occurred.[4]

A patient admitted from a nursing home was prescribed Humalog insulin 20 units in the morning and 8 units at night according to the documentation from the nursing home. This looked unusual to the pharmacist who confirmed the prescription should have been for Humalog Mix 25. The patient had been given the wrong insulin resulting in hypoglycaemia, which was reversed with intravenous glucose (dextrose).[5]

5. Develop or review guidelines for insulin use and consider including information on:
   - Different insulin formulations and insulin delivery devices.
   - Insulin pen cartridges and the pen device are for single patient use and must not be shared between patients due to the high risk of biological contamination. Discourage withdrawing insulin from a pen cartridge with a syringe and needle. If a syringe and needle is used, air may be introduced and the bung competency compromised. The pen cartridge must not then be used in a pen device due to the risk of dosing error. Ensure staff and patients are educated about correct user technique for pen devices.
   - Storage conditions, shelf life and labelling requirements for insulin for ward or individual patient use.
   - Placement of labelling on insulin container to ensure important information on the product is not obscured.
   - Use of only insulin syringes with units of insulin equivalents clearly marked or insulin pen devices for measuring doses of insulin. Ensure the correct insulin delivery device is used with specific insulin formulations.
   - Using a common insulin dose range within practical limits (eg single doses of fast acting and intermediate acting insulin are unlikely to exceed 25 units).
   - Insulin dosing during fasting and enteral feeding.
   - Introducing a dose validation system where doses larger than the common dose range require validation at the point of prescribing and before the dose is administered. Dose validation may be by a second authorised person and documented in the patient's medical notes.
   - A standardised insulin sliding scale system if one is to be used. Minimise the use of sliding scale dosing by co-ordinating insulin dosing with meal times. Consultant Endocrinologists often advise against the use of sliding scales, however they are frequently used.
   - As an alternative to a sliding scale develop an algorithm for supplemental doses of insulin based on the capillary blood glucose monitoring pattern. The supplemental dose should be added to the usual dose and administered at meal times to prospectively manage hyperglycaemia.
   - Consider enabling patients to self-administer insulin in hospital if they are competent to do so and/or confirm the dose with the patient. Include processes for determining patient competency in guidelines.
6. Consider educational posters on the range and names of insulin products to increase staff awareness. These are readily available from insulin manufacturers.
7. Review and rationalise the range of insulin formulations stocked in clinical areas:
   - Remove formulations, which are not routinely used from clinical areas. Individually dispense these when required.
   - Store different formulations in separate clearly identified containers.
   - Remove insulin outer packaging before storage in clinical areas.
   - Introduce TALLman[6] lettering for 'look-alike' products.
   - Consider placing colour photographs of the product on containers to aid identification.

   Note: the newer long acting insulin analogues such as glargine and detemir are clear solutions and can be confused with short and rapid acting insulins. They cannot be mixed with other insulins or administered in the same injection site and must be given at the same time each day.
8. Consider removing 100 Unit insulin syringes from wards. Replace with 50 Unit syringes. Individually supply patients with 100 Unit syringes after dose validation for doses greater than 50 Units.
9. Ensure appropriate education and competence and provide suitable insulin delivery devices to patients for home administration of insulin.
   - Involve the patient in insulin administration and monitoring processes during their inpatient stay to enhance adherence after discharge.

Moving from potential harm to safe care

Many organisations have implemented safety controls for the prescribing and administration of insulin, however it is recommended that all organisations evaluate their current procedures against the actions below.

Actions

Successful safety improvements require the development and implementation of sustainable procedures that are reviewed regularly and have commitment from the range of personnel involved in insulin therapy.

Roles and responsibilities

CEO

- Disseminate this alert to the relevant committees who take the responsibility to review and action these recommendations where appropriate. These bodies may include Clinical Governance, Quality Use of Medicines, Drug and Therapeutics, Medication Safety committees and directors of medical services, pharmacy and nursing.
- Identify a committee or individual to be responsible for completion of the insulin audit tool. The audit tool can be found at www.health.vic.gov.au/vmac/projects/hrm.htm
- Ensure results of regular reviews from the relevant committee(s) are made available to monitor the progress toward improving and maintaining systems in regard to insulin.

Clinical Governance, Quality Use of Medicines, Medication Safety, Drug and Therapeutics committees and directors of medical services, pharmacy and nursing

- Ensure an individual or committee is designated to complete the alert audit tool (available at: www.health.vic.gov.au/vmac/projects/hrm.htm) to evaluate insulin use in your organisation.
- Completing the tool may require some local gathering of evidence (such as sample audits) to confirm adherence with policies and guidelines. Recommendations 1 to 5 are organisational and need only be answered once. Recommendations 6 to 9 require local implementation therefore may need to be audited in each relevant clinical area.
- Assess the benefits and risks of current practices of insulin prescribing, administration and blood glucose monitoring in your organisation and review these practices in accordance with the recommendations of this alert.
- Consider the recommendations from the alert which are not in place in your organisation. Decide whether these are relevant to your service.
- Determine an action plan to implement recommendations your organisation plans to adopt. Ensure each action is allocated to a responsible committee or individual.
- Use the findings of the audit and action plans to regularly review and feedback to those committees with the responsibility for action.

Note: Recommendations are not compulsory. Other innovative solutions may be implemented to reduce the risks with insulin. Ensure these are documented on the 'audit tool.'

Other governance issues to improve insulin safety include:

1. Ensure a formal process exists for approving guidelines, prescription order forms and flow charts before use in your organisation.
2. Insulin guidelines and procedures should become part of your organisation's training programmes. They should be included in orientation and continuing education sessions for relevant clinical staff.
3. Assess and ensure the competency of medical, nursing and pharmacy staff in their roles and responsibilities for insulin therapy, according to your guidelines. This includes response to low blood glucose levels.
4. Provide effective communication, to all relevant staff, of changes to insulin formulations stocked and the guidelines and processes for documenting orders and blood results.
5. Ensure a reporting process is designed to capture insulin errors and near misses in your organisation. Use the reported events to develop error prevention strategies.

Acknowledgements and further information:

- How-to guide: Prevent harm from High-Alert Medications. 5 million lives campaign
  Available at: www.ihi.org/IHI/Topics/PatientSafety/MedicationSytems
  Accessed on: 23 October 2007
  (Information now found at: http://www.ihi.org/IHI/Programs/Campaign/HighAlertMedications.htm)
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5. Patient Safety Observatory, 2007 'Safety in doses- Medication Safety incidents in the NHS'. 4th report from Patient Safety Observatory. National Patient Safety Agency, London pp 36.
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