HSE National Patient Safety Alert (NPSA)
Date of issue 15 November 2023 ***Unique ID*** HSENPSA 003/2023

Access alert and resources online →

Potential risk of underdosing with calcium gluconate in severe hyperkalaemia

WHO needs to take action?

This is a safety critical HSE National Patient Safety Alert. This alert is for action by those providing acute medical care where severe hyperkalaemia in adults is likely to be treated. The Senior Accountable Officer supported by Drugs & Therapeutic Committees, Resuscitation Committees, Chief Pharmacists, emergency medicine specialists, the clinical leads for cardiology, nephrology, resuscitation /advanced life support, critical care, anaesthesia and critical outreach staff should coordinate implementation.

WHAT is the safety issue?

This alert highlights the need to update local policies and guidelines for the treatment of severe hyperkalaemia in **adults** regarding the **dosage and administration of calcium gluconate** used to protect the heart in severe hyperkalaemia.

Emergency treatment in severe hyperkalaemia to protect the heart and achieve the recommended calcium dose of 6.8 mmol is **30ml of calcium gluconate** 10% or **10ml calcium chloride** 10%. Both calcium salts (calcium gluconate and calcium chloride preparations), are available in 10ml vials therefore **three vials of calcium gluconate** are required to reach the dose equivalent to only **one vial of calcium chloride**. A repeat dose may be needed.

HOW to take action?

1. **Identify** a senior clinician in your organisation to lead the response to this alert.
2. **Review and update** local guidance for the treatment of severe hyperkalaemia– including mobile applications, handbooks, quick reference guides and/or supporting materials to ensure it aligns to the guidance on page 2. Where they are in use, hyperkalaemia kits should also be aligned with the guidance.
3. **Review and update** internal guidance to establish which calcium salt (calcium gluconate or calcium chloride) will be the first-line treatment for acute severe hyperkalaemia to stabilise the heart in acute hyperkalaemia. Ensure this is standardised across all wards and units so staff are accustomed to using the same product.
4. **Put in place** a process for escalation to seek support from critical care or advanced life support teams to support delivery of time critical treatment and monitoring for severe hyperkalaemia, which is life-threatening.
5. **Ensure** relevant guidance and resources are embedded in clinical practice by revising local training, simulation training and audit. Consider using peri-arrest/cardiac arrest audits to monitor standardised, safe practice across the service.
6. **Consider** putting accessible guidelines for treatment of severe hyperkalaemia in relevant clinical areas.
7. **Report** all medication incidents or near misses, including those with calcium gluconate and calcium chloride, via the National Incident Management System (NIMS).

WHEN does action need to be completed?

Please circulate this HSE NPSA to relevant staff by **29th November 2023.**
Actions 1-6 should be completed by **16th February 2024**.
Action 7 is not time bound and applies as part of required organisational practice.

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Why is this action required?

Severe hyperkalaemia (≥ 6.5 mmol/L of potassium) is a life-threatening emergency. The risk of associated arrhythmias and cardiac arrest increases in proportion to the severity of elevated potassium and can be unpredictable. Calcium salts do not reduce serum potassium but are given to stabilise the myocardium and prevent cardiac arrhythmias.

Measures to lower potassium levels must also be instituted immediately. ECG changes provide evidence of toxicity but may take time to develop and may not be present initially. Calcium salts are effective within 3 minutes at improving adverse ECG appearances (e.g. narrowing of the QRS complex). The dose should be repeated if there is no effect within 5-10 minutes. The duration of action is only 30-60 minutes, so further doses may be necessary if hyperkalaemia remains uncontrolled[1].

Local guidelines should reflect that:

- A **30ml** IV dose of calcium gluconate 10% should be given over 10 minutes or a **10ml** IV dose of calcium chloride 10% should be given over 10 minutes in patients with ECG changes to stabilise the myocardium and prevent/treat reversible cardiac arrhythmias.
- The effect of calcium salts is temporary. Repeat calcium doses if adverse ECG changes remain after 5 to 10 minutes.
- Urgent expert advice should be sought about administering calcium in patients with severe hyperkalaemia without ECG changes.
- ECG monitoring is advised for potassium levels above 6.0mmol/L. Continue to monitor ECG and serum potassium while severe hyperkalaemia is being treated.
- Involvement from critical care and advanced life support / outreach teams may facilitate more rapid and co-ordinated treatment.

What evidence supports this HSE NPSA?

Analysis of UK patient safety incident data included a fatal outcome and serious harm following underdosing of calcium gluconate in severe hyperkalaemia[2]. There is also evidence that there has been underdosing in the Irish context following a review of HSE incident data. No direct link from potential underdosing issues to poor patient outcomes were highlighted. However, some incidents that reported the deterioration of patients referenced the administration of low doses of calcium gluconate. There is also evidence that the incorrect lower dose of calcium gluconate has been referenced in some local Irish hospital guidelines.

Irish reference resources are currently limited and no national guidelines are available at this time. The correct dosing of calcium gluconate for the treatment of severe hyperkalaemia is referenced in a number of international resources [1,3,4]

Note: Product information, including the 'Summary of Product Characteristics' is available via www.hpra.ie for authorised medicines, including calcium chloride. Currently there are no intravenous calcium gluconate products with a marketing authorisation in Ireland.

Please note:

- Tissue necrosis is a serious adverse event if extravasation occurs during administration of both IV calcium salts. Ensure reliable intravenous access and test with flush prior to administration.

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What stakeholders were involved in issuing this HSE NPSA?

This alert was adapted from a UK National Patient Safety Alert[2]. It has been adapted for the Irish Healthcare setting collaboratively by the following:

- HSE National Clinical Lead for Renal Services
- HSE National Clinical Lead for Emergency Medicine
- HSE Nurse Lead Emergency Medicine Programme
- HSE National Clinical Lead for Anaesthesiology & Critical Care
- HSE National Clinical Lead for Cardiology
- National Quality & Patient Safety Directorate -Incident Management Team
- National Quality & Patient Safety Directorate -Medication Safety Team
- Irish Medication Safety Network
- Input from Health Products Regulatory Authority
- HSE National Patient Safety Alerts Committee

References

Please note that the non-Irish references are used to highlight the dosing requirements of calcium gluconate only, and have not formally been endorsed in full in Ireland.

- (1) UK Adult Renal Association Clinical Practice Guidelines (2020) for the treatment of severe hyperkalaemia
- (2) NatPSA June 2023 007 MHRA
- (3) BNF – Medicines complete
- (4) European Resuscitation Council Guidelines for emergency treatment of hyperkalaemia

Where can I get further information?

For queries on this alert or other HSE National Patient Safety Alerts please visit www.hse.ie/pst or email patientsafetytogether@hse.ie