High-risk medication alert: intravenous potassium chloride

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Summary

Patients have died in hospitals both in Australia and overseas after being mistakenly injected with potassium chloride instead of normal saline. In an effort to reduce the risks associated with the use of intravenous potassium chloride, the Australian Council for Safety and Quality in Health Care has issued a high-risk medication alert for intravenous potassium chloride. This alert contains recommendations for prescribing, storage, preparation and administration of intravenous potassium chloride.

Key words: adverse effects.

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Case 1

An elderly patient was admitted to hospital for investigation of weight loss and anaemia. The patient had a history of chronic renal failure and hypertension with underlying coronary disease. X-rays disclosed deteriorating cardiac failure.

As part of the investigation a colonoscopy was performed, but a perforation occurred necessitating a sigmoid colectomy. In the intensive care unit the patient developed cardiac complications with rapid atrial fibrillation and hypotension. The potassium concentration was 3.6 mmol/L (normal range 3.5–5.0 mmol/L) and was suspected as the cause of the atrial fibrillation. A dose of 2 g of potassium chloride was prescribed. This was administered as an intravenous infusion over a period of less than 10 minutes. The patient suffered a cardiac arrest and died. The inquest found that the rapid infusion of potassium chloride caused the cardiac arrest, which led to the death of the patient.[1]

Case 2

An elderly patient was admitted to hospital for terminal care. The patient was receiving total parenteral nutrition via a Hickman (Cook) intravenous catheter. This was flushed with heparinised saline three times per week. Instead of saline, two ampoules of potassium chloride were inadvertently selected and used to flush the catheter. Before the flushing was completed, a nurse observed that the patient 'clutched her chest and rolled her eyes'. The patient immediately had a cardiac arrest and died.

The coroner's investigation found that routine procedures for checking of the correct drug against the medication chart were not followed.[1]

Comment

The risks associated with intravenous potassium chloride are well known. If it is injected too rapidly or in too high a dose, it may cause cardiac arrest within minutes. The effect of hyperkalaemia on the heart is complex – virtually any arrhythmia may be observed.[2]

The true incidence of potassium-related fatalities and incidents is unknown. Fatal intravenous injection of potassium produces no specific anatomic changes and subtle, if any, findings at autopsy.[3] A search of the national Australian database of coronial findings (the National Coroners Information System) containing data from all States and Territories from January 2001 found no fatalities associated with potassium chloride. A more detailed keyword search was possible within the Victorian case management system. This uncovered five fatalities associated

Recommendations from Safety and Quality Council medication alert: intravenous potassium chloride can be fatal if given inappropriately [5]

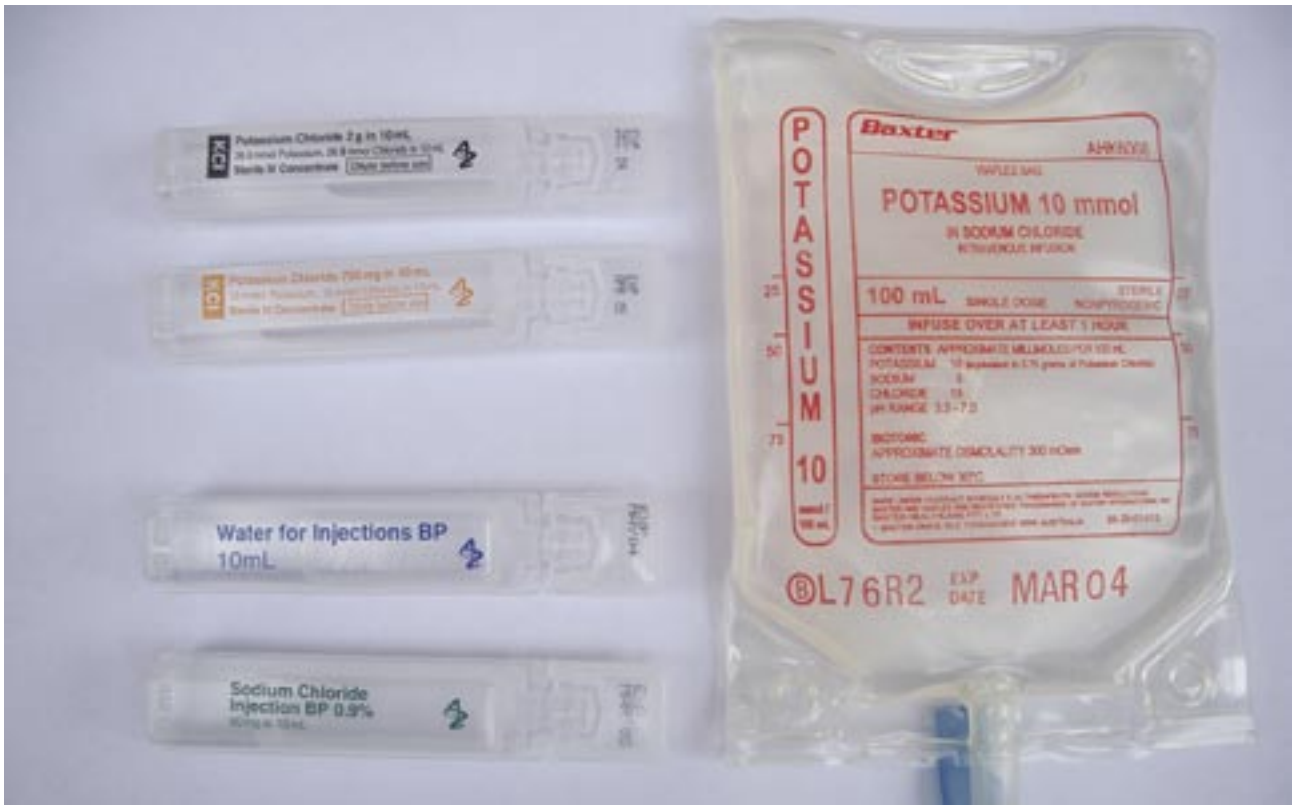
1. **REMOVE AMPOULES OF POTASSIUM CHLORIDE FROM WARD STOCK AND REPLACE WITH PREMIXED SOLUTIONS.**

   Due to the risk associated with intravenous potassium chloride, ampoules of potassium chloride SHOULD NOT be kept as a stock item in wards.
2. In critical areas where high concentrations and doses of potassium chloride are necessary, do a risk assessment to determine whether it is appropriate to keep the ampoules as a stock item and develop a protocol for safe preparation and use.
3. Assess the storage of potassium chloride ampoules and premixed solutions to ensure they are stored separately and are readily identifiable from preparations with similar packaging.

The recommendations also apply to ampoules of potassium phosphate or other concentrated potassium salts.

Fig. 1

Ampoules of potassium chloride have been confused with other ampoules (and administered by mistake)



Picture provided by J. Reeve

On left, 10 mL ampoules containing, from the top:

- Potassium chloride 2 g
- Potassium chloride 750 mg
- Water for injections
- Sodium chloride 0.9%

On right:

- Minibag of 750 mg potassium chloride in 100 mL sodium

with potassium chloride between 1992 and 1997 and an open case from July 2003. The Australian Incident Monitoring System (AIMS) and AIMS Anaesthetic databases contain details of more than 30 intravenous potassium chloride-related incidents (no fatalities).[4]

Medication incidents associated with intravenous potassium chloride tend to occur due to inadvertent selection and administration of an ampoule of potassium chloride in place of another drug with similar appearance (Fig. 1), or due to an error in preparation or administration.

Prevention

Analysis of incidents associated with intravenous potassium chloride have led patient safety organisations in the USA, Canada, the UK and Australia to recommend a simple way to prevent these tragic deaths – 'replace concentrated ampoules with large-volume premixed solutions in general ward areas in acute care facilities'.[4]

In areas where ampoules of concentrated solution need to be retained, it is recommended that they are stored separately and are readily identifiable from preparations with similar packaging. Overseas and in Australia, manufacturers are taking steps to reduce the problem by colour-coding and/or changing the shape of potassium chloride ampoules.

The Australian Council for Safety and Quality in Health Care has issued a high-risk medication alert for intravenous potassium chloride (see box for recommendations).[5] The alert covers prescribing, storage, preparation and administration of intravenous potassium chloride. The alert, and tools to action the recommendations in the alert, is available at www.safetyandquality.org

References

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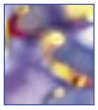
Conflict of interest: none declared



Bowel preparation

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Summary

Colonoscopy and radiological investigations of the large bowel require the bowel to be cleared of faeces. In addition to dietary restriction, patients are usually given a laxative, orally or rectally. Osmotic laxatives containing sodium phosphate are highly effective, but can cause severe electrolyte disturbances. Polyethylene glycol is an osmotic laxative which is less likely to cause this problem. It is given in an iso-osmotic solution, but patients have to drink several litres of fluid. Stimulant laxatives such as bisacodyl and sodium picosulfate are easy to use, but can also cause electrolyte disturbances.

Key words: laxatives, colonoscopy.

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Introduction

Complete cleaning of the large bowel is essential for colonoscopy and radiological investigation of the colon (barium enema and more recently CT colonography). Bowel preparation has also traditionally been used prior to colonic surgery although the evidence for its benefit is scanty.[1] Investigation for colonic disease is common nowadays so referring doctors should have an understanding of the cleaning products used (see box), their effects, adverse effects and contraindications.

General principles

All bowel preparation regimens require exclusion of high residue foods for at least 48 hours and a diet of clear fluids only for 24 hours before the examination. This will require adjustment of insulin and oral hypoglycaemic medications in patients with diabetes. Although some regimens require patients to drink a lot of fluid, overenthusiastic intake of water can induce hyponatraemia. Patients on diuretic therapy are especially at risk. Fluids free of non-absorbed sugars should be used to reduce the possibility of explosive gas mixtures within the colon.

If possible, medications that may aggravate constipation should be ceased (for example opiates, anticholinergics, antidiarrhoeals and iron supplements). Iron compounds tend to stick to the wall of the colon obscuring the view at colonoscopy and also inhibiting coating with barium during barium enema. Iron should ideally be stopped a week prior to the examination. It should be noted that oral medications taken at the same time as the bowel preparation may be poorly or incompletely absorbed (for example oral contraceptives, antihypertensives).

Examples of some of the products available for bowel preparation

Phosphate preparations	Fleet phospho-soda buffered saline mixture
	Fleet ready-to-use enema
	Phosphoprep
Polyethylene preparations (with electrolytes)	ColonLYTELY
	Glycoprep
Diphenylmethanes	
bisacodyl	Bisalax
	Durolax
	Fleet laxative preparations
sodium picosulfate (often combined with other laxatives)	Durolax SP
	Picolax
Magnesium preparations (combined with other laxatives)	Picoprep