

## A case of slow-release potassium chloride overdose

### 一個緩釋氯化鉀中毒的個案

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An 86-year-old gentleman was brought to the emergency department after a massive overdose of slow-release potassium chloride and indapamide. The initial serum potassium was 6.8 mmol/L. His abdominal X-ray did not reveal any radio-opaque drugs. Whole bowel irrigation was commenced shortly after presentation. There was no rebound of hyperkalaemia and his stay in the acute hospital was short. Slow-release potassium overdose is uncommonly reported in the medical literature; such poisoning in the elderly has not been reported. Previous case reports are summarised and the management of this uncommon poisoning is discussed. (*Hong Kong j.emerg.med.* 2007;14:169-173)

一名 86 歲男子服下極大劑量的緩釋氯化鉀及吲達帕胺後到急症室求診。最初的血鉀為 6.8 mmol/L。腹部 X 光沒有顯示不透光的藥物。他就診後不久開始進行全腸沖洗。高血鉀沒有反彈，而他在急症醫院只短暫停留。緩釋鉀中毒在醫學文獻很少有報導，而長者中毒更沒有報導過。本文概述以往的個案報告及討論這不常見中毒的治理。

**Keywords:** Aged, delayed-action preparations, irrigation, poisoning, potassium

**關鍵詞：**老年、緩釋製劑、沖洗、中毒、鉀

### Introduction

Slow-release potassium chloride (Slow-K) is a commonly prescribed potassium supplement. The elderly is the major group of patients consuming this drug. Overdose of slow-release potassium (SRP) is rarely encountered in our practice. In case of massive overdose of Slow-K, it is important to manage the hyperkalaemia. Gastrointestinal decontamination in SRP overdose is also of paramount importance.

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### Case presentation

An 86-year-old gentleman, with history of hypertension and regular follow-up in a government outpatient clinic (GOPD), was suspected to have early dementia and was referred to the memory clinic. Currently, he was on indapamide (Natrlix) 2.5 mg daily and slow-release potassium chloride (Slow-K, 600 mg or 8 mmol per tablet) 2 tablets per day. In March 2007, he was followed up three days before attending our department and was given a total of 41 tablets of Natrilix and 82 tablets of Slow-K. One day before attending our department, his daughter-in-law found that only a few tablets of the drugs were left. He was brought to the GOPD and was immediately referred to our department. He was estimated to have ingested at least 30 tablets of

indapamide and 70 tablets of slow-release potassium chloride (approximately 8 mmol potassium chloride/kg of body weight).

On presentation, he had no discomfort and denied any suicidal idea. His general condition was fair. However, he was mildly dehydrated and looked tired. He was fully conscious and afebrile. The blood pressure was 112/66 mmHg and the pulse rate was 86 beats per minute. Venous blood was sampled immediately (Table 1). The potassium level was 6.8 mmol/L. The electrocardiogram showed no features of hyperkalaemia. According to the computer record, the renal function test done four months before this consultation was normal (urea 7.1 mmol/L, creatinine 89  $\mu$ mol/L).

He was managed in our resuscitation room. The hyperkalaemia was treated with 10 ml 10% calcium gluconate, 100 ml 8.4% sodium bicarbonate, insulin and dextrose infusion (Actrapid HM 8 units in 50 ml D50 over 1 hour).

Although activated charcoal is believed to be ineffective in the adsorption of potassium salts, it was still given for suspected co-ingestion. The chest X-ray was unremarkable and the abdominal X-ray revealed no radio-opaque drugs. After resuscitation, he was closely monitored in the intensive care unit (ICU). In view of the significant hyperkalaemia and the potentially fatal dose of potassium exposure, whole bowel irrigation (WBI) was commenced for gastrointestinal decontamination. The serum potassium level dropped to 4.6 mmol/L one hour later. There was no rebound of hyperkalaemia afterwards. He was transferred out to the general medical ward the next day and then transferred to a convalescent hospital on Day 5. He ran an uneventful course in the convalescent hospital and was discharged home one month later. The long stay in the convalescent hospital was due to social

reasons and the need of the rehabilitation program for his poor mobility.

## Discussion

Indapamide is a common anti-hypertensive drug for the elderly. It is a thiazide diuretic with the side effect of hypokalaemia, so potassium supplement is usually given concurrently. The toxic dose of indapamide has not been established. Toxicity of indapamide is primarily associated with fluid and electrolyte loss that should be corrected with appropriate intravenous or oral fluid.<sup>1</sup>

SRP overdose has been uncommonly reported in the literature. An extensive medical literature search from 1966 to 2007 revealed only 10 case reports with the description of a total of 13 patients of SRP overdose (Table 2).<sup>2-11</sup>

The main concerns of SRP overdose are the potentially life-threatening hyperkalaemia and gastrointestinal complications such as vomiting, ulceration, haemorrhage and stricture.<sup>12,13</sup> SRP is less irritating but more likely to cause hyperkalaemia than immediate release preparations because vomiting may not occur. In adults with normal renal function, hyperkalaemia may occur if the potassium load exceeds the maximal excretory capacity. An acute ingestion of 2-2.5 mEq/kg (mmol/kg) may result in hyperkalaemia.<sup>14</sup> The absorption of Slow-K takes place in the small bowel over 3-4 hours in therapeutic doses; however hyperkalaemia may develop rapidly after a massive overdose. Illingworth and Proudfoot reported the death of a 26-year-old man who presented to the hospital 3.5 hours after ingestion of 24 grams of slow-release potassium chloride. His peak potassium level was 9.3 mmol/L.<sup>4</sup> Saxena reported a 46-year-old woman

Table 1. Results of the initial venous blood gas

Na (mmol/L)	K (mmol/L)	pH	PCO <sub>2</sub> (kPa)	PO <sub>2</sub> (kPa)	HCO <sub>3</sub> (mmol/L)	Base excess (mmol/L)
135	6.8	7.309	5.34	3.3	20.1	-6

Table 2. Summary of previous case reports of slow-release potassium overdose

Reference	Age (year)/ Sex	Amount of KCl (grams)	Co-ingestion	Peak serum potassium (mmol/L)	Gastrointestinal decontamination	Outcome
Bacon <sup>2</sup>	1.25	4.8	Nil	9.9	None	Died
Wetli & Davis <sup>3</sup>	32 F	27	Nil	10.8 ocular fluid (post mortem)	None	Died
Illingworth & Proudfoot <sup>4</sup>	36 M	Unknown	Cyclopentiazide	8.9	None	Survived
	58 F	12.6	Bendrofluazide	9.1	Gastric lavage	Survived
	26 M	24	Dextropropoxyphene, Paracetamol	9.3	Gastric lavage	Died
Colledge et al <sup>5</sup>	24 M	60	Mefenamic acid, Paracetamol, Phenylpropanolamine	7.9	Gastric lavage	Survived
Saxena <sup>6</sup>	46 F	60	Nil	9.6	Gastric lavage, Charcoal	Died
Steedman <sup>7</sup>	27 F	36	Nil	9.1	None	Survived
Davey & Kuhn <sup>8</sup>	39 F	48	Nil	12	None	Survived
Geluk & Braitberg <sup>9</sup>	27 F	60	Nil	6.5	None	Survived
Whitaker & Maguire <sup>10</sup>	2.5 M	Unknown	Nil	9.2	Whole bowel irrigation	Survived
Su et al <sup>11</sup>	50 F	75	Alprazolam, Ibuprofen	9.7	Gastric lavage, Whole bowel irrigation	Survived
	17 M	15-22.5	Nil	6.1	Whole bowel irrigation	Survived

who developed cardiac arrest within one hour of ingestion of 60 grams of SRP with peak potassium 9.6 mmol/L.<sup>6</sup>

Apart from the acute management of hyperkalaemia, gastrointestinal decontamination may be beneficial in SRP overdose. From Table 2, seven out of the 13 patients had received decontamination. One patient received both gastric lavage and activated charcoal.<sup>6</sup> Three received gastric lavage only.<sup>4,5</sup> Another patient received both gastric lavage and WBI.<sup>11</sup> Two received solely WBI.<sup>10,11</sup> Although data suggest that activated charcoal cannot adsorb potassium effectively as it is ionic and small in nature, it may be useful in case of co-ingestion.<sup>14,15</sup> Gastric lavage is another option for gastrointestinal decontamination if the drugs are still

considered to be remaining in the stomach. Performing lavage is not without risk. Apart from mechanical trauma and risk of aspiration, the procedure may affect cardiorespiratory function.<sup>16</sup> Illingworth and Proudfoot reported the death of a 26-year-old man who had ingested 24 grams of SRP and developed cardiac arrest with asystole during gastric lavage.<sup>4</sup> The second problem is technical difficulty. The tablet size of Slow-K is large with a diameter of 13 mm. In order to ensure the passage of one whole tablet of Slow-K, the internal diameter of the lavage tube should be at least 40 French.<sup>10</sup> The passage of such a large tube in small sized patients may be considered risky.

Whole bowel irrigation involves the use of polyethylene glycol electrolyte solution that is commonly used

nowadays for bowel preparation prior to investigation and surgery of the bowel. WBI is considered useful in managing overdose of substances that are poorly adsorbed by activated charcoal. WBI can be applied in the management of various drugs including iron, lead, zinc sulphate, sustained release theophylline, sustained release verapamil and can also be used to remove illegal drugs from "body packers".<sup>17-19</sup>

There were only two previous case reports mentioning the use of WBI in three cases of SRP overdose. However, the patients were young. Whitaker et al reported a 30-month-old child who had ingested an unknown amount of Slow-K.<sup>10</sup> The abdominal X-ray of this patient showed at least 32 tablets in the gastrointestinal tract. WBI was performed resulting in a significant reduction of radio-opaque tablets as shown in the subsequent film. The peak serum potassium was 9.2 mmol/L. The patient survived and developed no complication of his gastrointestinal tract after eight months of follow up. Su et al reported the use of WBI in two patients. In this report, the first patient was a 50-year-old woman who had ingested 75 grams of potassium chloride. Abdominal X-ray showed tablets in her gastrointestinal tract. Her peak serum potassium was 9.7 mmol/L with peaked T wave shown in the electrocardiogram. Although WBI was commenced approximately 13 hours after presentation, the decontamination was successful. The second case was a 17-year-old teenager who presented to the emergency room about 10 hours after the ingestion of approximately 15 to 22.5 grams of potassium chloride. WBI was commenced soon after his presentation. He had a shorter stay than the first case but it could be due to the lesser amount of potassium taken.<sup>11</sup>

Generally speaking, potassium preparations are radio-opaque and may be shown up in routine radiography.<sup>20</sup> Although the abdominal X-ray of our patient revealed no radio-opaque drugs, a negative film cannot rule out the diagnosis as radio-opacity varies among the same medication made by different manufacturers and is also affected by the size of the patient, air contrasting the pill and the arrangement of drugs within the stomach.<sup>20</sup> Notably, his initial hyperkalaemia (6.8 mmol/L) was

significant. However, it could be postulated that the peak serum potassium might be higher if he did not take any indapamide. Whole bowel irrigation with polyethylene glycol electrolyte solution was reasonable after commencing treatment for the hyperkalaemia. The patient was discharged to general medical ward from the ICU the next day and had no rebound of hyperkalaemia. The use of WBI might have contributed to the short ICU stay and the uneventful recovery.

## Conclusion

We reported a case of massive overdose of slow-release potassium and described the use of WBI in its management. Whole bowel irrigation appears to be one of the alternatives of gastrointestinal decontamination for the management of SRP overdose in the elderly.

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