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CASE REPORT

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Airway obstruction due to ingestion of sodium polyacrylate: a case report

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Abstract

Background Super-absorbent polymers (SAPs) possess the ability to absorb large amounts of water and are widely used in medical settings. Commonly used in vomit bags to contain fluids, reduce spillage, and enhance bedside hygiene, SAPs are generally regarded as safe and non-toxic. However, we report a tragic incident where the accidental ingestion of SAPs led to fatal asphyxiation, highlighting a critical safety concern.

Case presentation A 76-year-old female suffering from advanced Alzheimer's dementia was brought to the emergency department following a fall with cervical trauma. Following a complaint of nausea, she was given a vomit bag containing a sachet of approximately 9 g of SAP. Thirty minutes later, she was found deceased in the waiting area, with a grayish, half-hardened gel blocking her oropharynx and remnants of a chewed SAP sachet. Pathological analysis confirmed death by asphyxiation caused by the SAP expanding in her oropharynx upon contact with saliva.

Conclusions This case emphasizes the potential dangers of SAPs when accidentally ingested and it is imperative that such products are kept out of reach of vulnerable populations. In cases of airway obstruction, there are no specific treatments available. Laryngoscopy may be impossible, necessitating the prompt consideration of an emergency tracheotomy. Experimental data suggest the use of an aerosol of warm alkaline hydrogen peroxide solution to dissolve these obstructive foreign bodies, but further studies are needed to validate its use in emergency situations.

Keywords Airways obstruction, Asphyxia, Super-absorbent polymers, Sodium polyacrylate, Foreign body aspiration

Introduction

Super-absorbent polymers (SAPs), such as sodium polyacrylate, are capable of absorbing large amounts of water and react with fluids to form a semi-solid gel [1]. Their high absorbency makes them useful in many everyday products or children's toys [2]. In medicine, their primary applications are in absorbent dressings and some hygiene products. When ingested, SAPs can cause airway obstruction and acute asphyxiation upon contact with saliva. In this report, we detail the case of an elderly, immobilized and confused patient who accidentally ingested a very small amount of this product from a vomit bag left at her disposal, which caused a complete obstruction of the airway and acute asphyxia.

Case presentation

A 76-year-old woman was referred to the emergency department for investigation of cervical pain after a fall in her care institution the previous day. The patient was institutionalized due to advanced dementia with a history of prior alcohol abuse and chronic depression. Her medical record otherwise stated arterial hypertension and osteoporosis. On arrival at the emergency department, the patient was stable. She had a Glasgow Coma Scale of

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14 (E4, V4, M6) and was able to signal pain. During care in our department, the patient complained of nausea and a healthcare worker provided her with a vomit bag (Vommax®, Fannin (UK) Ltd, Stroud, UK), which contains a sachet of SAP. This helps to solidify the vomited liquids and prevent spills. Her musculoskeletal examination was notable for a slight cervical tenderness at the upper cervical spine. There was no focal neurological deficit. No external signs of trauma were observed. A computed tomography (CT) scan of the head showed no post-traumatic lesion. A CT of the cervical spine showed a fracture of the anterior C1. Hospitalization was proposed and the patient was moved to the waiting area with a cervical collar in place.

Approximately 30 min later, the patient was found dead in the waiting box. We observed a grayish half-hardened gel in her mouth with a torn, possibly chewed, plastic packing, as well as an empty vomit bag without the solidifying agent near the patient's bed (Fig. 1).

We suspected a SAP-induced asphyxiation. Cause of death was confirmed by the pathologist. Indeed, the post-mortem CT scan revealed that the oral cavity, oropharynx, larynx, and proximal part of the trachea were filled with a frothy material (Fig. 2).

The external examination showed a partially open mouth with a large quantity of whitish, granular material obstructing the oral cavity. Dissection of the neck organs found the same material filling the pharynx, larynx and the aerodigestive junction. The trachea was clear. Neuropathological examination revealed an undisplaced fracture of the anterior arch of the C1 vertebra, without injury to the spinal canal or spinal cord. Based on these findings, it was concluded that the death resulted from mechanical asphyxia due to obstruction of the upper airways (pharynx, larynx) by sodium polyacrylate and an alert was issued to remove the sachet of SAP from vomit bags.

Discussion and conclusions

SAPs, such as sodium polyacrylate, were developed in the 1980s. Sodium polyacrylate, also known as waterlock, is a sodium polyacrylic salt. When dehydrated, SAP appears as a white powder like sugar or salt. A small amount of this SAP, such as a simple sachet present in a vomit bag, can instantly absorb hundreds of times its own weight in water, forming a much larger, compact and viscous gel (Fig. 3) [1].

SAPs are thus capable of increasing their original size up to 200 times [2]. The degree of expansion differs

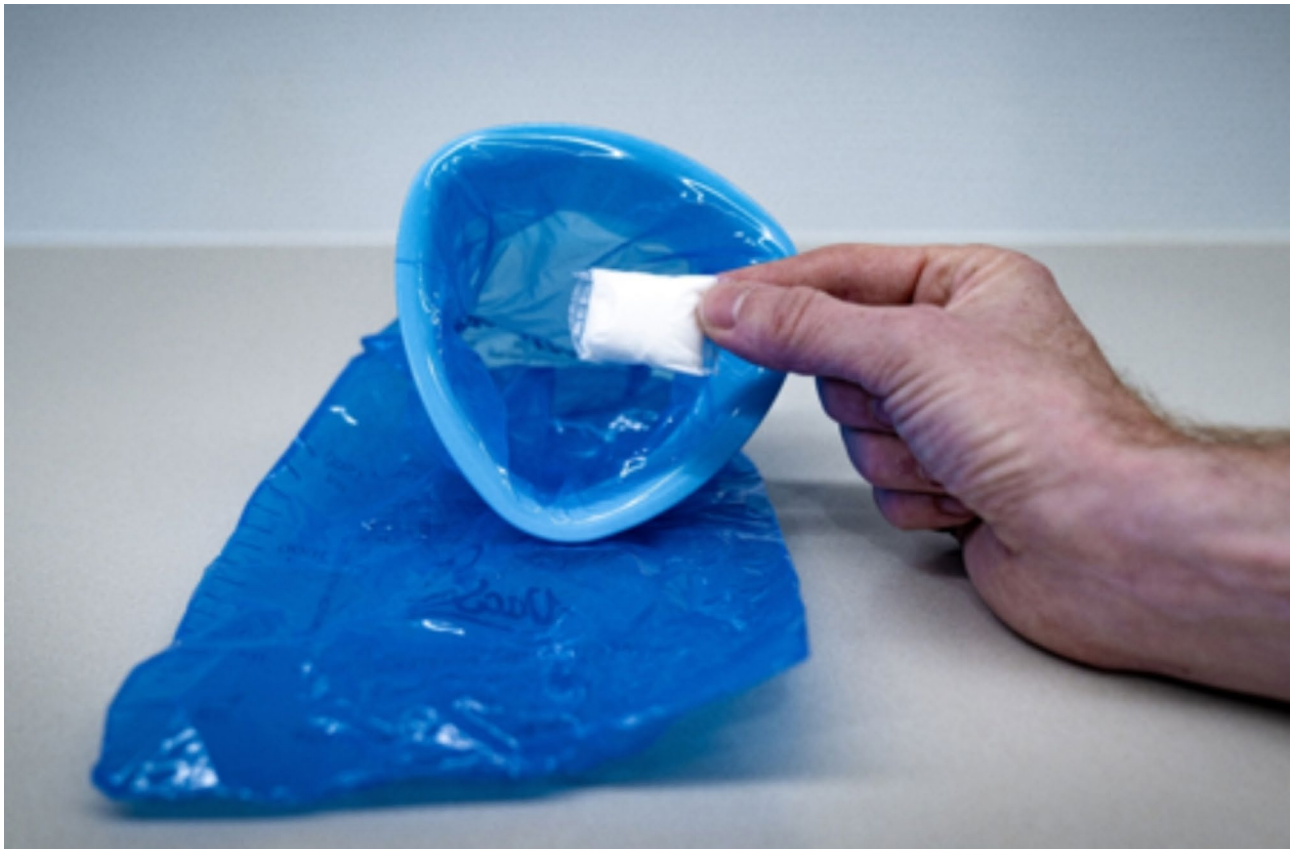

Fig. 1 Vomit bag (Vommax®) with the solidifying agent

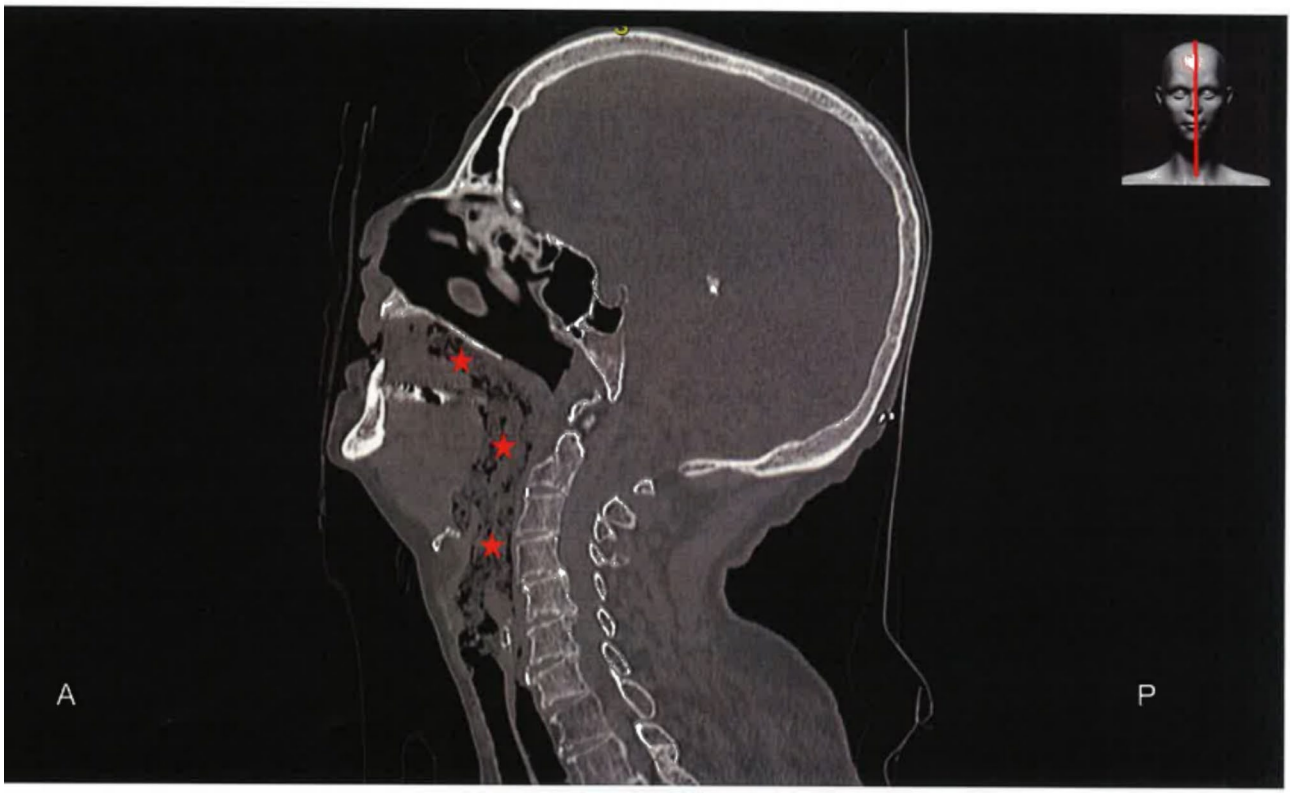

Fig. 2 Post-mortem computed tomography (sagittal section): filling of the oral cavity, oropharynx, larynx and proximal part of the trachea with frothy material (red stars)

Fig. 3 The super-absorbent polymer powder bag absorbs water and creates a solid gel

according to the liquids in contact with the polymer. This absorbency makes it useful in many everyday products (e.g., hygiene products, such as disposable nappies or sanitary towels, intimate lubricating gels, decorative objects, water tanks for plants, children's toys and humidity control agents). It is also used in the health sector as an absorber of body fluids such as urine (nappies) or gastric fluid (vomit bag) (Fig. 1). It facilitates the disposal of bodily fluids and prevents spills and is intended to increase patient hygiene and comfort, as well as reducing the workload of care staff for cleaning bodily fluid spills. Although the manufacturer advises against direct use on skin and in body orifices, as well as in children's toys, the chemical mixture has been well studied and is considered to be safe [3]. Eye irritation has been described for sodium polyacrylate in animal studies, but other

toxicological or irritant effects have not been observed. Airway and lung irritation has been described due to the adjunct silicon dioxide.

However, even if reputed to be non-toxic and harmless, the product can expand to a very large volume when in contact with saliva and cause airway obstruction in children and frail patients who may accidentally ingest it. We identified a significant risk associated with the use of gelling agent adjuncts in vomit bags, despite the apparently safe toxicological profile. Even if this type of accident seems rare in adults, it has also been described by other teams [1]. A Patient Safety Alert concerning the use of the gelling agent was issued in the UK in 2017 due to 15 relevant incident reports (1 severe harm, 3 low harm, 11 no harm) and one death [4]. In pediatrics, teams report the risks of intestinal, external auditory canal and respiratory system damage associated with the handling of super-absorbent polymer beads. They also warn of the risk of respiratory distress caused by airway obstruction [5–8].

In the case of airway obstruction, restoring patency can be complex. The product formed by the combination of SAP and saliva is viscous and becomes rapidly voluminous and occlusive. It cannot be suctioned and is difficult to extract. Laryngoscopy is often impossible and an emergency tracheostomy should be considered. Recent experimental studies suggest administering a warm alkaline hydrogen peroxide solution via aerosol to restore airway patency for respiratory gases in cases of obstruction. According to these authors, an aerosol of this solution with a pH of 8.5 rapidly dissolves sputum and mucus, converting them into oxygen foam, thus facilitating the easy and rapid removal of biological masses from the airways [9]. However, more studies are needed before this method can be used in current practice in cases of airway obstruction caused by SAP.

In conclusion, this case clearly illustrates the potential risks associated with the use of SAPs, even in healthcare settings. The potential benefits of a reduced spilling of bodily fluids need to be balanced against the risk of severe harm when accidentally ingested, especially in patients with reduced cognitive capacities. This product should not be left within the reach of vulnerable people and healthcare professionals need to be made aware of the risks associated with these products.

Abbreviations

SAPs Super absorbent polymers
CT Computed tomography

Author contributions

A.S. and T.S. wrote the main manuscript text. C.L.B. and Y.G. provided valuable revisions to the text. A.S., T.S., C.L.B. and Y.G. approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Consent for publication

The patient gave their written consent for the publication of this case.

Competing interests

The authors declare no competing interests.

Ethical approval

Not applicable.

Consent to participate

Not applicable.

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