Benzalkonium chloride exposure in cats

Benzalkonium chloride is commonly found in household products, particularly disinfectants and some patio cleaners. Cats are typically exposed to these products after use, rather than from chewing or knocking over the container. The signs most commonly reported after exposure to benzalkonium chloride in cats are hypersalivation or drooling, tongue ulceration, hyperthermia, oral ulceration, inappetence and lethargy. It is important to note that the onset of signs is typically delayed and that owners may not immediately associate the cat’s clinical condition with the use of the product hours previously. A typical initial clinical picture of benzalkonium chloride exposure in cats is hyperthermia, hypersalivation and inflammation or ulceration of the tongue. Treatment is supportive and recovery takes, on average, 4 days.

Benzalkonium chloride (BAC, alkyl(dimethyl)benzylammonium chloride) is a quaternary ammonium compound (QAC) which is classified as a cationic detergent. Anionic and non-ionic detergents are commonly used in cleaning products, but QACs are used extensively as domestic and industrial disinfectants and rarely as simple cleaning agents.

Mechanisms of action
Detergents are surfactants (surface active agents) that reduce the surface tension of water; they concentrate at oil and water interfaces and possess emulsifying properties. The primary adverse effects from benzalkonium chloride exposure are due to its irritancy which results in local tissue damage. It has been shown to interact with proteins and lipids in biological membranes, and studies on the use of benzalkonium chloride in eye drops have shown that it produces an immuno-inflammatory reaction.

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The Veterinary Poisons Information Service (VPIS) is a 24-h telephone emergency service providing information on the management of actual and suspected poisoning in animals. It provides direct support to veterinary professionals worldwide.

See http://vpisglobal.com/ for more information and how to sign your practice up to receive this vital service.
Sources and circumstances of exposure

Benzalkonium chloride is found in household antibacterial cleaners and disinfectants. Other sources include mould removers and patio cleaners and cats are often exposed after the product has been used by licking contaminated feet and fur.

In cats, exposure to benzalkonium chloride products typically occurs by ingestion and/or dermal exposure after the product has been used, rather than from chewing or knocking over the container. Walking on or licking surfaces treated with a household antiseptic or disinfectant is a particular risk for feline exposure to benzalkonium chloride, and dermal contamination usually results in subsequent exposure of the tongue and oral mucosa because of the grooming behaviour in cats. Automatic hand cleanser dispensers are battery-operated devices designed to dispense cleanser when triggered by a hand in close proximity to the sensor, but a passing cat can also act as a trigger and be accidentally exposed. Most cases of benzalkonium chloride exposure in cats involve household antibacterial cleaners and disinfectants.

In Europe, the typical concentration of benzalkonium chloride in household products is between 0.2% and 5% (E Colson, McBride, personal communication 2014). In humans, the most severe injury occurs with exposure to solutions of 10% or more, but this is not the case with cats who develop signs after exposure to much lower concentrations. Another potential risk is the use of a product, such as patio cleaner, that has not been diluted in accordance with the manufacturer’s instructions.

There are often no immediate clinical signs following exposure to benzalkonium chloride and as a consequence no action is taken to decontaminate the cat or limit exposure. Owners may be unaware that their cat has been exposed until they develop signs hours later.

Presentation and treatment

Clinical signs

Benzalkonium chloride exposure is characterised by gastrointestinal irritation and tissue damage with hypersalivation and inflammation of the tongue 12 h after licking a patio treated with a cleaner containing benzalkonium chloride. (Picture courtesy of Bates and Edwards 2014)
associated signs. The most common signs in a review of 245 cases of exposure in cats reported to the Veterinary Poisons Information Service (VPIS) in the UK cats were hypersalivation or drooling, tongue ulceration, hyperthermia, oral ulceration, inappetence, lethargy, depression, vomiting and anorexia. Signs associated with respiratory irritation (eg, respiratory distress) and dermal irritation (eg, inflammation, burns or dermatitis) may also occur. The mechanism of hyperthermia is unclear but may be due to an inflammatory response, stress or pain.

Apart from the recent case series there are few feline cases of benzalkonium chloride exposure reported; these involved exposure in laboratory facilities to concentrated solutions rather than clinical cases from exposure to household products. Anorexia, hypersalivation, depression, dehydration, stomatitis with mucosal ulceration, nasal and ocular discharge and dermal ulceration were reported in cats housed in a facility that was cleaned with a product containing 20% benzalkonium chloride that had not been diluted as specified by the manufacturer (1:400). In another report, chemical burns were reported in cats and dogs after use of an undiluted electrical conductant containing benzalkonium chloride (17%) during routine electrocardiographic monitoring. In this incident three cats developed severe oral ulceration after licking the affected areas of skin and one developed oesophagitis and oesophageal stricture.

Signs of irritation and ulceration of the gastrointestinal tract beyond the mouth and pharynx were not reported in the review of VPIS cases which mostly involved exposed to domestic products. A typical initial clinical picture of benzalkonium chloride exposure in cats is hyperthermia, hypersalivation and inflammation or ulceration of the tongue. In such cases owners should be asked about recent use of disinfectants, patio cleaners and other household products that can contain benzalkonium chloride.

Figure 1 shows a cat with a typical presentation after exposure to benzalkonium chloride with hypersalivation and inflammation of the tongue. Figure 2 shows another
cat with progression of signs and development of ulcerated blisters on the tongue 2 days after exposure.

Onset of effects
There may be no early signs of benzalkonium chloride exposure and effects, when they do develop, are non-specific. This delay in presentation may exacerbate the effects as the cats are not decontaminated promptly and may groom and lick exposed skin and fur.

In the review of VPIS cases of benzalkonium chloride exposure the mean onset of signs was reported as 6.4 h (median 4.5 h), although the range was very wide (5 mins to 48 h). Telephone contact with the VPIS did not occur until a mean 14 hours after exposure.\(^3\)

The first signs to occur, typically within the first 10 hours after exposure are generally lethargy, inappetence or anorexia and hypersalivation. The mean onset of tongue and/or oral ulceration has been reported as 8.8 and 16.5 h, respectively. Hyperthermia was reported in approximately a third of cases and was generally apparent by 24 h.\(^3\)

Treatment
Treatment of benzalkonium exposure in cats will depend on how long has elapsed between exposure and presentation.

In cats that present soon after exposure prompt decontamination is recommended. Emesis is not recommended as the product is a potential aspiration hazard and could increase the risk of respiratory signs. Also the amount typically ingested is very small, particularly if the cat has been licking a treated surface. Activated charcoal is very unlikely to be of benefit in these cases and is not recommended. Irrigation of the oral cavity may be helpful with the use of a short-acting anaesthetic to facilitate decontamination, if required. It is also important to wash exposed skin, including the feet.

It is more common for cats to present late and for these animals treatment is symptomatic and supportive. Atropine can be given for hypersalivation and analgesia is recommended if they have evidence of inflammation of the tongue and/or oral mucosa.

Rehydration is often required as cats may not have been eating or drinking because of oral discomfort and pain. In the review of 245 cases, only 5.3% of cats were reported to have been given syringe or nasogastric feeding, despite the high incidence of oral and tongue ulceration.\(^3\) Steroids and gastroprotectants have also been used,\(^3\) but the efficacy of these interventions in benzalkonium

Tip
Treatment is supportive; emesis should be avoided. Attention should be focused on analgesia, nutrition and correction of dehydration.
chloride exposure in cats has not been evaluated. Antibiotics have also been commonly used but it is unclear if their use is justified. Routine endoscopy is not recommended as tissue injury beyond the mouth is not common. Oxygen therapy can be given in cats with respiratory signs.

Duration of effects and outcome

Recovery in cats with benzalkonium chloride exposure is typically prolonged and the majority of cats require several days of supportive treatment. Most cats recover fully. In the review of 245 cases the time to full recovery was reported in 67 cases and ranged from 1 to 360 h (15 days) with a mean of 100.4 h (4.2 days).

Deaths have been reported in cats exposed to benzalkonium chloride. In the review of 245 cases, three cats (1.2%) died. Details were limited in two of these cases but in the third, the cat was exposed to a patio cleaner containing 7.5% benzalkonium chloride (presumably diluted as directed to produce a 1.9% solution) and developed severe tongue and laryngeal oedema which progressed to obstructive airway disease after she sat on the treated patio in the rain. Approximately 45.5 h after exposure she had a cardiac arrest and died.

Conclusions

Household products containing benzalkonium chloride are a serious hazard to cats. Although fatal cases are rare, these products cause significant damage to the oral mucosa. Presentation is typically delayed and recovery can take several days.

Acknowledgements

With thanks to Kate Russell and Julian Hoad for the images.

References