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Lesson of the week: Alcohol hand rubs - Hygiene and hazard

Abstract
Hospital acquired infections are common and increase morbidity, mortality, and length of stay. The benefit of hand washing has been highlighted, and studies have shown that alcohol hand rub is significantly better than soap in reducing hand contamination. In 2004, NHS trusts were advised to introduce "near patient" alcohol based hand rubs (for example, attached beds and at entrances to wards) by April 2005.

With the widespread introduction of these hand rubs, risk assessments were made for the possibility of fire and ingestion. Although alcohol hand rub is flammable, no incidents involving fire have occurred. The risk of ingestion was thought possible in children and confused patients, but little advice was given on reducing this risk. Frequent dermal application of alcohol based hand rub has been shown not to raise blood ethanol levels. However, no further risk assessment has examined unintentional or intentional ingestion of alcohol rubs.

We report a case of considerable toxicity associated with the deliberate ingestion of alcohol based hand rub, together with data from our poisons unit showing an increase in inquiries related to alcohol rubs.

Keywords
alcohol, hazard, hand, lesson, rubs, hygiene, week

Disciplines
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Where am I now?

I've learnt to live in new ways: to celebrate the good days and try to use them. Equally, I have to accept the bad times—even if that means days or weeks when all I can be is the "sick" person. My condition can change rapidly, so I have to stay ready to adapt within days.

Emotionally it's hard to shift paradigms at the drop of a hat. There's no point being permanently optimistic, for then it feels catastrophically painful to slip down again. Conversely, there's no point being permanently pessimistic, for then there'd be no joy in life, no possibility of experiencing each moment for itself.

I would love to have been more upbeat describing this journey, but the truth is more complex. Of course, I hope that medicine will provide a real cure, though there's no scientific indication of that on the horizon. So I can only hope that pemphigus, the drugs, pain, and disability will leave me enough space to live an altered, but still worthwhile, life.

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LESSON OF THE WEEK

Alcohol hand rubs: hygiene and hazard

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Young or confused people and those dependent on alcohol are at risk from ingestion of alcohol hand rubs

Hospital acquired infections are common and increase morbidity, mortality, and length of stay.[1 2] The benefit of hand washing has been highlighted,[3] and studies have shown that alcohol hand rub is significantly better than soap in reducing hand contamination.[4-7] In 2004, NHS trusts were advised to introduce "near patient" alcohol based hand rubs (for example, attached beside beds and at entrances to wards) by April 2005.[8]

With the widespread introduction of these hand rubs, risk assessments were made for the possibility of fire and ingestion. Although alcohol hand rub is flammable, no incidents involving fire have occurred. The risk of ingestion was thought possible in children and confused patients, but little advice was given on reducing this risk.[8] Frequent dermal application of alcohol based hand rub has been shown not to raise blood ethanol levels.[9] However, no further risk assessment has examined unintentional or intentional ingestion of alcohol rubs.

We report a case of considerable toxicity associated with the deliberate ingestion of alcohol based hand rub, together with data from our poisons unit showing an increase in inquiries related to alcohol rubs.

Alcohol hand rub preparations: volumes available, ingredients and their concentrations (%)

Preparation	Volumes available (ml)	Ethanol concentration (%)	Other ingredients (percentage concentration)
1	75, 100, 500, 1000	<55	Isopropanol (<25)
2	150, 500	30-60	Isopropanol (10-30), benzylalcohol (<10), hydrogen peroxide solution (<10), perfume (<10), polyoxyethylene caprylic/capric glycerides (<10), denatonium benzoate*
3	60, 125, 350, 1000	62	Isopropanol (<5)
4	60,150, 500	65-75	Glycerol (<10), actrylic acid homopolymer (<1), triethanolamine (<1), denatonium benzoate*
5	60, 125, 350, 1000	80	Isopropanol (<5)

*Bittering agent.

Case report

A patient known to have a history of alcohol dependency presented with withdrawal symptoms, having not consumed alcohol for 24 hours. On examination the patient was alert, orientated (with a Glasgow coma score of 15/15), with tachycardia (95 beats/min), tremulous, and sweaty, but with no focal neurological abnormalities. Intravenous thiamine and chlordiazepoxide were started under the hospital alcohol withdrawal protocol. During this admission, the patient was found collapsed (coma score 3/15), having vomited in the bathroom, holding an empty 500 ml bottle of alcohol hand rub, and lying next to another such bottle (preparation 4 in the table).

The patient was intubated and ventilated and transferred to the intensive care unit, where intravenous antibiotics were started for aspiration pneumonia. Computed tomography of the head was normal, and blood ethanol concentration at the time of collapse was 7g/l (152.2 mmol/l). This is nine times over the legal UK driving limit (0.8 g/l) and is a potentially fatal concentration.[10] The patient was normoglycaemic and had normal renal function; liver function tests were in keeping with chronic alcohol excess, and she had a mild metabolic acidosis. On questioning after extubation, the patient denied any intent to self harm.

We searched the Guy's and St Thomas' Poisons Unit's database to compare the numbers of inquiries related to both children and adults exposed to alcohol hand rub (both ingestion and eye exposure) during the 16 month periods before and after the widespread introduction of alcohol hand rubs (December 2003 to March 2005 and April 2005 to July 2006 respectively) . The search found an

increase in the total number of inquiries about alcohol rub (from 23 to 50) to the poisons unit. However, when the total general call rate to the poisons unit is taken into account, there is also a large proportional increase (303%) in the total number of inquiries relating to exposure between the two periods (P<0.01). Here the most marked increase, 314% (7 *v* 29 inquiries), was in adult ingestion numbers (intentional and unintentional), 66% (19) of which were thought to be the result of intentional ingestion. All cases of ingestion occurred within hospitals or care homes. Unintentional ingestion occurred in very young people and in elderly people and in those confused, whereas intentional ingestion occurred only in those with alcohol dependency.

Discussion

The NHS Purchasing and Supply Agency have five alcohol hand rub products available (table). These products contain varying quantities of hydrogen peroxide and other ingredients (but all in smaller quantities than ethanol and isopropanol). However, the main risk from ingestion is the potential for ethanol and/or isopropanol poisoning.

We have had inquiries about all five types of preparations, including those containing denatonium benzoate (a bittering agent, which would make preparation less palatable). Isopropanol may occur in concentrations as high as 30% and can cause effects similar to those of ethanol. Depending on previous tolerance to ethanol, deaths have been associated with ingestions of 100-250 ml of a 70% isopropanol solution.[11 12] The adverse effects of ethanol are variable, with chronic ingestion causing tolerance to high blood ethanol concentrations as an adaptive process.[13] Survival in patients with very high blood ethanol concentrations (>10 g/l) has been reported.[14]

Owing to the wide variation in individual response and tolerance to ethanol, a "toxic dose" of alcohol hand rub is difficult to establish. However, in a normal adult as little as 360 ml of an alcohol hand rub containing 80% ethanol could potentially lead to life threatening complications, but this will vary depending on previous exposure to ethanol.[10]

After exposure to an alcohol hand rub clinical effects generally occur within 1-2 hours of ingestion. The most common adverse effects are those of ethanol intoxication, including epigastric pain and vomiting. More serious effects involve depression of the central nervous system, leading to aspiration and respiratory arrest. If a patient develops symptoms, medical attention should be sought. Management is largely supportive, although if a large volume of hand rub is thought to have been ingested, close observation is required in case of ensuing depression of the central nervous system and its sequelae. In our experience the more serious effects are seen in those who ingest more than 500 ml of hand rub, and this is most likely to occur in confused patients (such as, they may mistake it for water) and those with alcohol dependency seeking the desired effect.

Similar gel-like hand sanitisers containing alcohol have been used by inmates in correctional facilities in the United States to generate more palatable ethanol by passing alcohol rub through simple table salt contained in a sock.[15] This further highlights the potential for misuse of these products.

Poisoning from alcohol hand rub remains relatively uncommon but has increased since widespread introduction of the hand rubs in the UK. Potentially serious clinical effects can occur with ingestion. With the wide distribution of these products in hospitals, the possibility of unintentional exposure, self harm, and misuse is more apparent. This is particularly important in patient areas that are easily accessible by those thought to be at high risk of ingestion. In these areas the larger hand rub dispensers (≥500 ml) could be placed within locked secured holders preventing unintentional or intentional withdrawal of the container and ingestion. This potential for toxicity presents a major challenge to patients' safety and to risk management, which needs a multidisciplinary and coordinated approach from risk managers, toxicologists, and infection control specialists.

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