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REVIEW ARTICLE

Use of bleach baths for the treatment of infected atopic eczema

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ABSTRACT

Atopic eczema is one of the most common skin disorders in young children and also affects adults. *Staphylococcus aureus* infection is the most frequent complication of atopic eczema and is involved in the worsening of the disease. Antibiotic therapy against *S. aureus* has been an important component of treatment for atopic eczema but there are concerns about antibiotic overuse and increasing bacterial resistance. This has led some clinicians to recommend the use of homemade remedies such as bleach baths as an adjunctive treatment for patients with infected atopic eczema, despite the fact that there have been few published studies in this area. Balancing safety concerns with efficacious treatment is of particular importance in the paediatric population. This review discusses the historical use of bleach in medicine as well as its recent use for atopic eczema. Further, the chemistry and safety of bleach as well as alternative therapies are examined.

Key words: antibiotic, atopic dermatitis, atopic eczema, bleach bath, emollient, sodium hypochlorite, *Staphylococcus aureus*.

INTRODUCTION

Atopic eczema is a chronic, itchy, superficial inflammation of the skin that affects 10–20% of children and 1–3% of adults.[1] Childhood atopic eczema has been recognised as having a profound impact on the social, personal, emotional and financial perspectives of families.[2] Between 1997 and 2004, paediatric patients with atopic eczema accounted for an estimated 7.4 million visits to the doctor in the USA alone, costing an estimated US$364 million to US$3.8 billion per year.[3]

Up to 90% of adults with atopic eczema have been found to be colonised with large numbers of *Staphylococcus aureus* on their skin, which can be cultured not only from eczematous plaques but also from clinically normal skin, the anterior nares and subungual spaces.[4] The mechanisms proposed for this high prevalence of colonisation include the increased adherence of bacteria to inflamed skin, defective skin barrier function, decreased innate antibacterial activities, reduced immune responses against bacteria and skin surface pH changes towards alkalinity.[5] In contrast, only 5% of the normal population carry *S. aureus*, which is largely found in the nares and intertriginous areas.[6]

The most common cause of exacerbation of atopic eczema is attributable to an overgrowth of *S. aureus*, which can be independent of true secondary bacterial infection.[7] The role of *S. aureus* in atopic eczema and the differentiation between *S. aureus* colonisation and infection is not clear, but it is known that *S. aureus* plays a significant role in the worsening of disease severity by producing superantigens.[7] Both lesion and non-lesion skin carry superantigenic-producing *S. aureus*, which are capable of modifying T-cell responses, resulting in the increased inflammation of lesions.[8] It has been shown that a reduction in *S. aureus* levels on the skin is accompanied by an improvement in the clinical condition.[9]

Topical and/or systemic antibiotic treatment of *S. aureus* improves both the secondary infections and severity of atopic eczema.[9] However, the emergence of methicillin-resistant *S. aureus* identified in the general population presents a therapeutic challenge for patients with atopic eczema.[10] Given the concerns regarding antibiotic overuse and increasing bacterial resistance patterns, diluted bleach baths analogous to swimming in a chlorinated pool are

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Abbreviations:

NaOCl	sodium hypochlorite
NaOH	sodium hydroxide
HOCl	hypochlorous acid
OCl	hypochlorite ion$^-$
SSTI	staphylococcal skin and soft tissue infections

currently being recommended by some clinicians as an adjuvant treatment that can help decrease the number of local skin infections and reduce the need for antibiotics in atopic eczema patients with heavily colonised and/or superinfected skin. These 'homemade remedies' consist of varying dosage strengths of sodium hypochlorite (NaOCl) bleach and schedules.[11] Here we discuss the historical use of bleach in medicine as well as its recent use in the form of bleach baths as an adjunctive treatment for patients with infected atopic eczema. Further, the chemistry and safety of bleach, as well as alternative therapies are also examined.

HISTORICAL USE OF SODIUM HYPOCHLORITE IN MEDICINE

NaOCl has been used in medicine as a disinfectant and antiseptic since the 18th century.[12] Among early uses, the Marquis de la Motte used NaOCl for the treatment of gangrene in 1732 and Paris surgeons used it for the treatment of burns, operative wounds and ulcers.[13] In the 19th century Hungarian obstetrician Ignaz Semmelweis found that NaOCl used as an antiseptic hand wash and on instruments prevented the transmission of post-partum fever.[12,13] The antiseptic properties of NaOCl were reported by Koch in 1880;[13] however, its widespread acceptance and recognition were largely ignored until World War I.[12,13] To reduce the high rate of wound infection complications among injured soldiers during this time, chemist Henry Dakin developed a buffered solution of 0.45–0.5% NaOCl that was not irritating while preserving its antiseptic properties.[12,13] Although antibiotics were introduced after World War II it was subsequently found that they often do not reach bacteria in deep wounds or necrotic tissue, have a limited spectrum of activity and resistant strains can develop.[12] Due to these limitations, topical antiseptics have again increased in use with another resurgence in the clinical use of Dakin's solution, albeit at lower concentrations.[14] More recent antiseptic uses of NaOCl include the treatment of burns,[15,16] wounds,[14,17,18] pressure sores[17] and deep ulcers[17,19] at concentrations ranging from 0.025[18] to 0.5%.[19] NaOCl at a concentration of 2 to 5.25% is one of the mostly widely used of all endodontic irrigating solutions.[20,21] Further, *in vitro* studies have shown that NaOCl concentrations as low as 0.005% are effective specifically against *S. aureus* in wounds and skin ulcers.[22,23]

STUDIES ON THE USE OF BLEACH BATHS

Despite the fact that there have been very few clinical studies published on the use of bleach baths for infected atopic eczema, they are being suggested as a treatment option by some clinicians since bleach is readily accessible, inexpensive and well-tolerated.[24]

One of the first studies that suggested that the use of bleach baths may reduce the incidence of recurrent *S. aureus* cutaneous superinfection, including methicillin-resistant *S. aureus* among susceptible groups was presented as a poster at the 2007 Society for Paediatric Dermatology Annual Meeting.[24] As an anti-staphylococcal measure, clinic outpatients and household members with a history of cutaneous superinfection with *S. aureus* were treated with both intranasal mupirocin ointment (a pea-sized amount applied to the anterior nares twice daily for 7 days a month for 6 months), and with bleach baths (2 teaspoons of 6% household bleach per gallon of bath water or 0.25 US cup per full bathtub or 60 mL of 6% bleach per 225L water to give a final concentration of 0.016% NaOCl twice weekly for 6 months).[24] This dilution of bleach was compared to that of 0.06 teaspoons per gallon or 0.078 mL/L in a normally chlorinated swimming pool.[24] A retrospective chart review of 243 children clinically diagnosed with atopic eczema were observed to have a dramatic decrease in culture-confirmed *S. aureus* skin infections concomitant with the implementation of these measures.[24] In continuing these preventative measures, *S. aureus* infections decreased from 60 to 6 cases a year with the treatment being well tolerated.[24]

In 2008 Krakowski and colleagues outlined a protocol for the use of bleach baths (Table 1) and suggested that diluted bleach baths, analogous to swimming in a chlorinated pool, are an adjuvant anti-infective treatment that can help decrease the number of local skin infections and reduce the

Table 1 Protocol to make a bleach bath (reproduced from Krakowski and colleagues)[25]

Explain to patients that their skin may benefit from 'swimming in pool water'. Then give them these instructions for making a pool right in their very own bathroom.
Add lukewarm water to fill the bathtub completely (about 40 gallons of water [151L]).
Depending on the size of the bathtub/amount of water used, add 0.25–0.5 US cup (60–120mL) of common bleach solution to the bath water. Any sodium hypochlorite 6% solution will do (for example, Chlorox liquid bleach); the goal is to make a modified Dakin's solution with a final concentration of about 0.005%.
Stir the mixture to ensure that the bleach is completely diluted in the bath water.
Have patients soak in the chlorinated water for 5 to 10 minutes.
Thoroughly rinse skin clear with lukewarm, fresh water at the end of the bleach bath to prevent dryness and irritation.
As soon as the bath is over, pat the patient dry. Do not rub dry, as this is the same as scratching.
Immediately apply any prescribed medications/emollients.
Repeat bleach baths 2–3 times a week or as prescribed by the physician.
The following restrictions apply:
• do not use undiluted bleach directly on the skin. Even diluted bleach baths can potentially cause dryness and/or irritation.
• do not use bleach baths if there are many breaks or open areas in the skin (for fear of intense stinging and burning).
• do not use bleach baths in patients with a known contact allergy to chlorine.

need for systemic antibiotics for patients with atopic eczema with heavily colonised or superinfected skin.[25]

In 2009 Huang and colleagues conducted the first randomised, investigator-blinded, placebo-controlled study on the use of bleach baths for patients with infected atopic eczema.[26] In all, 31 patients aged from 6 months to 17 years, with moderate to severe atopic eczema and clinical signs of secondary bacterial infections were studied.[26] All patients received cephalexin at 50 mg/kg (maximum 2 g/day) divided into three daily doses for 2 weeks to treat their staphylococcal infections prior to randomisation. The treatment group received intranasal mupirocin ointment (intranasally twice daily for 5 consecutive days each month) and NaOCl bleach baths (0.5 US cup of 6% bleach per full bathtub/40 gallons water or 120 mL of 6% bleach per 144L water to give a final concentration of 0.005% NaOCl twice weekly for 5 to 10 minutes for 3 months), while the placebo group received intranasal petrolatum ointment treatment and plain water baths for 3 months.[26] All patients maintained a stable regimen of topical anti-inflammatory medication and emollient therapy throughout the 3 month trial.[26] Patients in the treatment group showed significantly greater mean reductions from baseline in eczema area and severity index scores, compared with the placebo group, after 1 month (-10.4 ± 2.8 *vs* -2.5 ± 1.6) and 3 months (-15.3 ± 3.8 *vs* -3.2 ± 1.6).[26] The mean eczema area and severity index scores for the head and neck did not decrease for patients in the treatment group at 1 (-0.98 ± 0.86 *vs* -0.16 ± 0.80) or 3 months (-1.06 ± 1.04 *vs* -0.57 ± 0.86), whereas scores for other body sites submerged in the bleach baths decreased at 1 (-2.61 ± 0.60 *vs* -0.78 ± 0.55) and 3 months (-4.94 ± 0.74 *vs* -0.88 ± 0.62), in comparison with placebo-treated patients.[26] One patient from the treatment arm reported itching and irritation of the skin with the use of bleach baths.[26] It was concluded that the chronic use of dilute bleach baths with intermittent intranasal application of mupirocin ointment decreases the clinical severity of atopic eczema in patients with clinical signs of secondary bacterial infection.[26]

In 2010 Vlachou and colleagues described the use of Milton sterilising fluid, which contains 2% NaOCl, without additional additives, including surfactants and perfumes generally found in household bleach, which may exacerbate eczema.[27] Three children aged 4 to 11 years with moderate to severe eczema with concomitant signs of bacterial infection were treated.[27] All had positive nasal and skin cultures of *S. aureus* and required up to three courses of antibiotics in the preceding 3 months despite optimum topical treatment.[27] All children were treated with oral flucloxacillin for 1 week, nasal mupirocin for 5 days and bleach baths (250 mL Milton sterilising fluid per full bathtub/120L water to give a final concentration of 0.004% NaOCl, twice weekly for 5 to 10 minutes for 2 months).[27] The children's usual topical emollients and corticosteroids were used throughout the treatment period.[27] At 2 months all three children improved. The investigators' global assessment showed mild eczema with no further infective exacerbations.[27] The treatment was well tolerated without any reported adverse reactions.[27]

Although not specifically in relation to atopic eczema, the most recent open-label randomised controlled trial on the use of bleach baths for eradicating *S. aureus* carriage included 300 patients (adults and children) with community-onset staphylococcal skin, soft tissue infections (SSTI) and *S. aureus* colonisation in the nares, axilla or inguinal folds.[28] The participants were randomised to receive one of four interventions: no therapeutic intervention; 2% mupirocin ointment applied to the nares twice daily for 5 days; intranasal mupirocin plus daily 4% chlorhexidine body washes for 5 days or intranasal mupirocin plus daily bleach baths (0.25 US cup of 6% NaOCl per bathtub to give a final concentration of 0.002–0.009% NaOCl, considering typical bathtub sizes and volumes for 5 to 10 minutes for 5 days).[28] Modified intention-to-treat analysis revealed *S. aureus* eradication at 1 and 4 months, respectively, of 38% and 48% of participants in the control group, 56% and 54% of those in the mupirocin group, 55% and 54% of those in the mupirocin and chlorhexidine group, and 63% and 71% of those in the mupirocin and bleach group.[28] At 1 and 4 months, recurrent SSTI were reported by 20% and 36% of participants, respectively.[28] A total of 39 patients reported adverse events including dry skin (7%), rash (3%) and nasal irritation (1%).[28] A greater number of reactions were experienced by participants who underwent chlorhexidine body washes (20%) and bleach baths (25%) than control subjects (6%).[28] It was concluded that an inexpensive regimen of dilute bleach baths, intranasal mupirocin, and hygiene education effectively eradicated *S. aureus* over a 4 month period.[28]

PROPERTIES OF HOUSEHOLD BLEACH

NaOCl is the active compound found in commercial household bleaches. Household bleach is a clear, yellowish, alkaline (pH 11–13) aqueous solution with a characteristic odour and strong oxidising properties, containing approximately 3–6% available chlorine at the time of manufacture, approximately 0.5–1.5% sodium hydroxide (NaOH) as a stabiliser and often small amounts of surfactants, perfume and sud suppressors.[12,29,30] The strength of household bleach varies from one formulation to another and gradually decreases with long storage, containing half the available chlorine at the expiry date (Table 2).[25,30] Decomposition is affected by many factors including temperature, chlorine concentration, light, the presence of catalysts and, most importantly, pH.[25,30] The main use of these products is as laundry bleaches but they are also used for household disinfection and cleaning.[29] NaOCl is manufactured by electrolysis where chlorine gas is bubbled into cold and dilute NaOH to form equal amounts of NaOCl and NaCl.[12] Mixed with water, NaOCl combines to generate highly reactive hypochlorous acid (HOCl), giving rise to its potent antibacterial and antifungal properties.[12] HOCl generates superoxide radicals that cause oxidative injury and cell death.[12] Bleach has a broad spectrum of action, being effective against bacteria (both Gram positive and Gram negative), spores, fungi and viruses.[29,31] In addition, NaOCl has been

Table 2 Properties of bleach products purchased from Australian supermarkets

Brand	AUST L	NaOCl concentration (g/L)	Available chlorine (% m/v)	Available chlorine at expiry date (% m/v)	NaOH concentration (g/L)	Expiry date (Y/N)
Black & Gold bleach (regular)	–	15	1.5	1.0	2.5	N
Coles Smartbuy bleach (regular, lemon)	–	35	3.3	–	4	Y
Power Force liquid bleach	–	42	4	1.9	9	Y
Riviera premium grade bleach (regular)	–	–	<3.7	–	–	N
Supremé premium liquid bleach	–	–	–	–	–	N
White King concentrated bleach (regular, lemon)	–	63.0	6.0	2.4	11	Y
White King premium bleach (regular, lavender, lemon)	58799	42	4.0	2.0	9	Y
Woolworths Homebrand bleach (regular, lemon)	–	–	4.2	–	<9	N

Black & Gold bleach, Campbell Consumer Products, Smithfield, NSW; Coles Smartbuy bleach, Coles Smartbuy, Hawthorn East, Victoria; Power Force liquid bleach, Aldi Stores, Minchinbury, NSW; Riviera premium grade bleach (regular), Riviera Whitemount Products, Somerton, Victoria; Supremé premium liquid bleach, Loral Ipsum, Bayswater, Victoria; White King concentrated bleach (regular, lemon), Sara Lee Household and Body Care, Pymble, NSW; White King premium bleach (regular, lavender, lemon), Pental Products, Shepparton, Victoria; Woolworths Homebrand bleach (regular, lemon), Woolworths, Bella Vista, NSW. NaOCl sodium hypochlorite, NaOH, sodium chloride. AUST L numbers are issued by the Therapeutic Goods Administration and indicate that the product is accepted for supply in Australia and is included on the Australian Register of Therapeutic Goods.

shown to have both *in vitro* and *in vivo* antimicrobial activity against *S. aureus*, including methicillin-resistant resistant *S.aureus*.[32,33] The optimal bleach concentration required to kill community-associated methicillin-resistant *S. aureus* has been shown to be 2.5 μL/mL, which is suggested to be equivalent to 0.5 US cup (120 mL) of 6% bleach in a 0.25 filled bathtub (13 gallons; 48/L) to give a concentration of NaOCl of 0.015%.[32]

CHEMISTRY, TOXICITY AND CARCINOGENICITY OF SODIUM HYPOCHLORITE

Chemistry

When NaOCl is dissolved in water two reactive chlorine species are generated, giving rise to its potent antibacterial and antifungal properties, namely HOCl and hypochlorite ion (OCl^-), according to the following chemical reaction:[29]

$$NaOCl + H_2O \leftrightarrow HOCl + NaOH$$

$$HOCl \leftrightarrow H^+ + OCl^- \ (K_a = 3.7 \times 10^{-8};\ pK_a = 7.43)$$

The relative amounts of the various active chlorine species depend mainly on the pH and to a lesser extent on the concentration of chloride ions. Chlorine gas is generated significantly below pH 2; HOCl is the predominant species between pH 2 and 7.5, whereas ClO^+ is predominant in the alkaline region.[29] Mixing NaOCl with ammonia solutions (including urine) gives rise to chloramine compounds. For example:[29]

$$NH_4OH + NaOCl \rightarrow NaOH + NH_2Cl + H_2O$$

Mixing NaOCl with acid solutions (including cleaning the toilet bowl) can cause a release of chlorine gas. For example:[29]

$$NaOCl + 2\,HCl \rightarrow Cl_2 + H_2O + NaCl$$

Table 3 Safety directions and warnings found on bleach products purchased from Australian supermarkets

Safety directions and warnings
Attacks eyes and skin
Avoid contact with skin and eyes
Corrosive
Do not mix with hot water
Do not swallow
Do not use on therapeutic devices
Ensure adequate ventilation when using
Irritant
Keep out of reach of children
May give off dangerous gas if mixed with other products
May produce severe burns
Not intended to be used on therapeutic devices
Use only as directed
Vapour may be harmful
Wash hands after using
Wear eye protection and protective gloves when mixing or using

Toxicity

The use of NaOCl as a disinfectant, including its topical use in medicine as an antiseptic, has proved to be safe since the 18th century.[12] However, exposure to NaOCl beyond topical use, whether it is intentional or accidental, is associated with significant risks due to its strong oxidising properties.[12] Potentially damaging scenarios include its ingestion, inhalation or deposition into tissue, which can lead to significant morbidity and even mortality.[12] These concerns are highlighted by the safety directions and warnings found on bleach products purchased from Australian supermarkets, as illustrated in Table 3. The toxicity of NaOCl has been reviewed in detail.[12,15,29]

NaOCl is toxic because of the hypochlorite moiety that is formed when NaOCl is dissolved in water in alkaline conditions.[29] Accidental domestic exposure to NaOCl is relatively common and was found to be involved in approximately 6% of total calls recorded by several European

poison control centres, representing 10–20% of all calls for poison by domestic products.[29] Interestingly, children up to 3 years of age were involved in such accidental exposures in 20–40% of cases.[29] The main route of exposure in children is via ingestion, while in adults the inhalation of gases formed by the mixing of NaOCl with acidic or alkaline solutions is the most frequent route of exposure.[29] Dermal or ocular exposure may also occur.[29]

The ingestion of small volumes of 3–5% NaOCl solution may cause irritation of the oropharynx, a burning sensation in the mouth and throat, thirst, nausea, vomiting and haematernesis.[12,35] The ingestion of large amounts or more concentrated solutions may also cause corrosion of the mucous membranes, chest and abdominal pain, watery diarrhoea and sometimes melaena.[12,35] In very severe cases ulceration or perforation of the oesophagus or stomach may occur leading to haemorrhage and shock.[12,35]

Inhalation of the fumes is irritant to the eyes, nose and respiratory tract.[12,35] Sore throat, cough, bronchoconstriction, headache, ataxia and confusion may develop.[12,35] In severe cases dyspnoea and stridor due to laryngeal oedema may develop with breathlessness, wheeze, hypoxia, cyanosis, pneumonitis and pulmonary oedema.[12,35] In some instances pulmonary damage may lead to long-term reactive airways dysfunction syndrome, a chemical irritant-induced type of asthma following an acute respiratory exposure to an irritant gas.[12]

NaOCl solutions may be irritating to the skin and allergic contact dermatitis has been reported.[12,35] In addition, NaOCl solutions may cause an alkali-type burn when splashed into the eye.[12,35] There are no data indicating that NaOCl, without severe maternal toxicity, is associated with adverse effects on reproductive function, pregnancy or lactation in humans.[34]

Carcinogenicity and genotoxicity

There are no data available from studies in humans on the carcinogenicity of hypochlorite salts. Due to inadequate evidence for the carcinogenicity of hypochlorite salts in experimental animals, the International Agency for Research on Cancer have assigned hypochlorite salts to group 3; compounds that are not classifiable as to their carcinogenicity in humans.[34] NaOCl has been shown to have some mutagenic activity in both bacterial and mammalian cells *in vitro*.[34]

ISSUES TO CONSIDER WHEN USING BLEACH BATHS FOR ATOPIC ECZEMA

Bleach concentration

The use of bleach baths for the treatment of infected atopic eczema relies on mixing the correct concentration of NaOCl in the bath water. Table 2 shows the varying concentrations of bleach available from Australian supermarkets today, which range from 1.5–6%, including one bleach product with no specified NaOCl concentration. Bleaches decompose over time can lose up to half their activity by the expiry date (Table 2).[25,30] Therefore, depending on the formulation of bleach and the time used after manufacture, bleach concentrations can vary dramatically. For example, in the bleaches purchased from Australian supermarkets shown in Table 2, the NaOCl concentration varied from 0.75–6%, an eightfold difference.

Further, although the standard Australian bath is approximately 1500–1800 mm long, 750–800 mm wide and around 400 mm deep (450–576L), today's bath sizes vary according to style, increasing the complexity of adding the correct amount of bleach to a full bath of water. To accurately reproduce the same bleach concentration in a bath each time you must know how old the bleach is; determine the concentration of active bleach present; measure exactly how much water is put in the bath and calculate the amount of bleach required to give the desired final bleach concentration. Too much NaOCl risks burns and irritation, while too little is of no therapeutic use.

Other irritants in bleach

As well as containing approximately 3–6% NaOCl, household bleaches usually also contain up to 0.5–1.5% NaOH as a stabiliser and often small amounts of surfactants, perfume to hide the smell, and sud suppressors.[12,29,30] Skin contact with NaOH will produce caustic irritation or burns due to the defatting and saponification of skin oils and the destruction of tissue, giving a slippery feel on the skin due to this process.[35] Surfactants (such as co-codimethylamine, sodium laureth sulfate and amine oxide), perfumes and sud suppressors are also known to be skin irritants.[29,36,37]

Limitations of human studies

To the best of our knowledge, to date only four studies have been published on the use of bleach baths,[24,26–28] and only one of these is a randomised controlled trial, albeit small, in patients with atopic eczema.[26] This study has been discussed in detail.[38] Limitations of this study include the fact that the number of patients infected with *S. aureus* at the start and end of the trial did not change; the treatment consisted of bleach baths plus nasal mupirocin, which means any changes could not be attributed to either treatment; there was a difference in the baseline severity of patients in the placebo compared to the treatment group, with the treatment group having a greater disease severity; one in nine participants using bleach baths experienced itching and irritation of the skin; the use of concurrent treatments for eczema was not reported.[38] Similarly, the two other published studies on the use of bleach baths for the treatment of atopic eczema,[24,27] as well as one study on the use of bleach baths for the general population with SSTI and *S. aureus* colonisation[28] all used bleach baths with concurrent treatment with nasal mupirocin. This makes it difficult to attribute any changes observed to bleach baths alone.

Interestingly, the concentration of bleach used in these studies varies from 0.004–0.016%, a fourfold difference.[24,26–28] A variety of regimens for the use of bleach baths to treat infected atopic eczema have also been recommended by

clinicians from as weak as 'one capful' of bleach in a full bathtub of water to as strong 1 full US cup of bleach in a 0.25 bathtub of water, with patients soaking in these solutions for as long as 20 to 30 minutes at a time.[11]

Safety

NaOCl has been used in medicine as a topical antiseptic in many applications such as for the treatment of burns, wounds and ulcers, or for cleaning the root canal system in endodontics. When used in this fashion, its toxicity is extremely low, a fact that has been proven with animal models as well as being observed in humans over time. The products containing NaOCl used for these applications (Dakin's solution) have been specifically manufactured under controlled conditions for medical use and have been assessed and approved for safety and efficacy by the relevant bodies. However, the use of household bleach added to bath water as a treatment for infected atopic eczema is a homemade remedy and, as such, has not been subjected to the rigorous testing usually applied to therapeutic products.

Bleach is an extremely accessible chemical and can be found in reasonably high concentrations in nearly every home. It is this ease of access and the potential for the incorrect mixing of bleach baths that makes understanding the potential implications of NaOCl exposure so important. These safety concerns have been outlined above.

Further, the use of bleach baths has been likened to swimming in chlorinated pool water. Exposure to chlorine in swimming pools has been shown in some studies to increase the risk of developing asthma in children and adults as well as causing dermatitis and irritating the skin.[39–41]

ALTERNATIVES TO BLEACH

Topical antiseptics are used as alternative treatments to antibiotics for patients with atopic eczema. The advantages of antiseptics include the fact that their potential to induce resistance in *S. aureus* strains, even with repeated and widespread use, seems to be very low; different preparations are available to suit individual needs according to disease activity, area and concomitant treatment; they rarely cause delayed-type hypersensitivity in contrast to some topical antibiotics.[42] Antiseptics available for home use during bathing include benzalkonium chloride and triclosan.

Benzalkonium chloride is a widely used quaternary ammonium antiseptic and preservative and is a rare sensitiser.[45] Benzalkonium chloride has been used in cosmetic and therapeutic products since 1935 and has been declared by the American College of Toxicology to be safe for use in cosmetics at a concentration of 0.1%.[44]

Triclosan is a synthetic, nonionic, broad spectrum, chlorinated bisphenol antiseptic that has been used in personal care products for more than 30 years.[45] Triclosan containing cleansers and the addition of triclosan to an emollient has been recognised as an effective way to treat large areas of atopic eczema.[46] Triclosan has been shown to have anti-inflammatory activity as well as having a favourable toxicity and sensitisation profile.[47,48]

A randomised, double-blind parallel-group study found that daily use of antiseptic bath oil containing benzalkonium chloride and triclosan over a 4 week period can reduce the level of *S. aureus* on eczematous skin and leads to a significant improvement in clinical symptoms.[49] Similarly, a double-blind, crossover comparative study also found a significant improvement in clinical symptoms in eczematous patients following daily use of an antiseptic bath oil containing benzalkonium chloride and triclosan over 4 weeks.[50]

Other antiseptics with future potential for use in baths at home include chlorhexidine gluconate and potassium permanganate.[42]

CONCLUSIONS

In conclusion, NaOCl, the active ingredient in household bleach is a very common chemical that has been used in medicine as well as in commercial situations dating back to the 18th century for its disinfectant properties.[12] NaOCl used as a topical antiseptic in many applications such as burns and ulcers or for cleaning in endodontics has been shown to be safe in animal models and observed in humans over time. The advantages of using NaOCl in the form of bleach baths as an adjunctive treatment for patients with infected atopic eczema are that it has a broad spectrum of action, being effective against bacteria (both Gram positive and Gram negative), spores, fungi and viruses; no microbial resistance phenomena have been reported with NaOCl, unlike most antibiotics; it is widely available and it is inexpensive.[29]

NaOCl can be found in much higher concentrations than used medically in nearly every home. Exposure to NaOCl is associated with significant risks due to its strong oxidising properties, which is particularly important to remember when it is used around children. Even at dosages analogous to swimming in a chlorinated pool, NaOCl may exacerbate asthma and lead to dermatitis.[38–40] Further, the dosage delivery of NaOCl is unreliable, given the varying concentrations of bleach products available, the decomposition of NaOCl over time and the large variation in the size of household baths today. Bleach products also generally contain fragrances and other chemicals that have been shown to be irritants, which may aggravate eczema.[34–36]

There is a paucity of clinical studies published in the literature on the use of bleach baths for the adjunctive treatment of patients with infected atopic eczema. These few studies, including only one clinical trial in patients with infected atopic eczema,[26] have been conducted using very small numbers of patients and their data are confounding due to limitations of the studies.[24,26–28] In addition, there is no consensus as to the optimal dosage and regimen of bleach baths required to reduce the frequency of *S. aureus* infections. Therefore, until further clinical trials prove the safety and efficacy of bleach baths for the treatment of infected atopic eczema, clinicians should carefully consider the pros

and cons before using bleach baths, as well as considering available alternatives on the market today.

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