

Chlorhexidine: an unrecognised cause of anaphylaxis

Katy Mara Odedra, Sophie Farooque

Chest & Allergy Clinic, Mint Wing, St Mary's Hospital, Imperial College Healthcare NHS Trust, London, UK

Correspondence to

Katy Mara Odedra, Chest & Allergy Clinic, Mint Wing, St Mary's Hospital, Imperial College Healthcare NHS Trust, Praed Street, London, W2 1NY, UK; katy.odedra@nhs.net

Received 23 July 2013

Accepted 30 September 2014

Published Online First

28 October 2014

ABSTRACT

Chlorhexidine is a highly effective antiseptic and disinfectant. In the past 20 years there has been a substantial increase in the number of chlorhexidine containing products used in healthcare. Anaphylaxis to chlorhexidine was first reported in 1984 and was almost always seen in men. However, in the last 4 years we have observed a surge in confirmed cases of anaphylaxis to chlorhexidine, with increasing numbers of female patients recently diagnosed. Yet, awareness of chlorhexidine as a cause of anaphylaxis is low because it is not a drug but a 'hidden' allergen, for example as a coating on medical devices such as central lines and urinary catheters. Patients will often have more than one allergic/anaphylactic reaction before the diagnosis is suspected. We have observed that there is poor recognition of an initial allergic reaction to chlorhexidine, which is well described. This, alongside poor labelling of chlorhexidine containing products, has resulted in further inadvertent exposure resulting in severe anaphylaxis. Prompt referral to a specialist allergy centre ensures appropriate investigations, diagnosis and management. Increasing awareness of the potential risk of life-threatening anaphylaxis associated with chlorhexidine use is vital, particularly in perioperative procedures. Healthcare workers are fundamental in avoiding and preventing further reactions to chlorhexidine containing products in patients diagnosed with anaphylaxis to chlorhexidine.

INTRODUCTION

Chlorhexidine belongs to the family of biguanides.¹ It is an antiseptic and disinfectant and is active against a broad spectrum of bacteria including methicillin-resistant staphylococcus aureus (MRSA), viruses and fungi.² Since its introduction in 1954, chlorhexidine has been increasingly used in secondary care and in products available over the counter such as contact lens solutions, mouthwashes and cosmetics.² In the hospital setting chlorhexidine is routinely used for: skin asepsis prior to inserting vascular access cannulas, as a lubricant before inserting indwelling urinary catheters and is used to coat central lines and dressings (see [box 1](#)). In clinical practice the concentrations in use range from 0.05% to 4%.²

According to the Medicines and Healthcare products Regulatory Agency (MHRA) licencing records, the percentage of products containing chlorhexidine has increased substantially over the past 20 years, see [figure 1](#). Between 1984 to 1992 only 11 chlorhexidine containing products were authorised, increasing to 21 by 2000 and by 2012 63 chlorhexidine containing products were available for use.² This does not include marketing authorisations that are currently under assessment. This increase in chlorhexidine containing products registered under the MHRA clearly identifies its

popularity, which may explain the increasing susceptibility to sensitisation.

The first case series of allergy to chlorhexidine was published in *The Lancet* in 1965,³ the first case of chlorhexidine induced contact allergic dermatitis having been reported 3 years earlier.⁴ Anaphylaxis to chlorhexidine has been reported since 1984.⁵ A PubMed search revealed that from 1994 to 2013 65 case reports of chlorhexidine-related anaphylaxis were published worldwide⁶ and eight of these reports in the last 5 years are summarised in [table 1](#). True incidence of chlorhexidine anaphylaxis is likely to be underestimated in view of its use as a disinfectant and thereby may be overlooked as a causative factor.

Several of the earlier reports^{7–9} collected retrospective data from patients who had experienced chlorhexidine induced anaphylaxis and noted that prior to these events many of the patients had experienced mild urticarial reactions to chlorhexidine. This is further supported by published case studies listed in [table 1](#). In addition, our own clinical experience suggests that these warning reactions are being missed. This raises concerns over the use of chlorhexidine as an antiseptic.

At least three studies investigating the efficacy of antiseptics in catheter care concluded that the use of antiseptics in the periurethral area pre catheter insertion had no benefit in reducing bacteriuria.^{10–12} A systematic review investigating skin asepsis for prevention of blood culture contamination demonstrated inconclusive results when comparing chlorhexidine versus iodine compounds versus alcohol alone.¹³ However, a recent meta-analysis by Lee *et al*¹⁴ concluded skin asepsis with chlorhexidine was more effective and cost saving than iodine products in preventing infections at surgical sites. Alcohol has historically been recognised and used as an effective antiseptic. Many studies have investigated the effectiveness of a chlorhexidine-alcohol combination without considering the role of the alcohol

Box 1 Widely used chlorhexidine containing products in the UK

Central venous lines
Urinary catheters
Skin cleaning solutions such as hand gels and surgical skin preparations
Surface cleaning sprays/solutions
Lubricating gels
Mouthwashes/products
Eye-drops/creams/ointments
Antiseptic dressings
Cosmetics



CrossMark

To cite: Odedra KM, Farooque S. *Postgrad Med J* 2014;**90**:709–714.

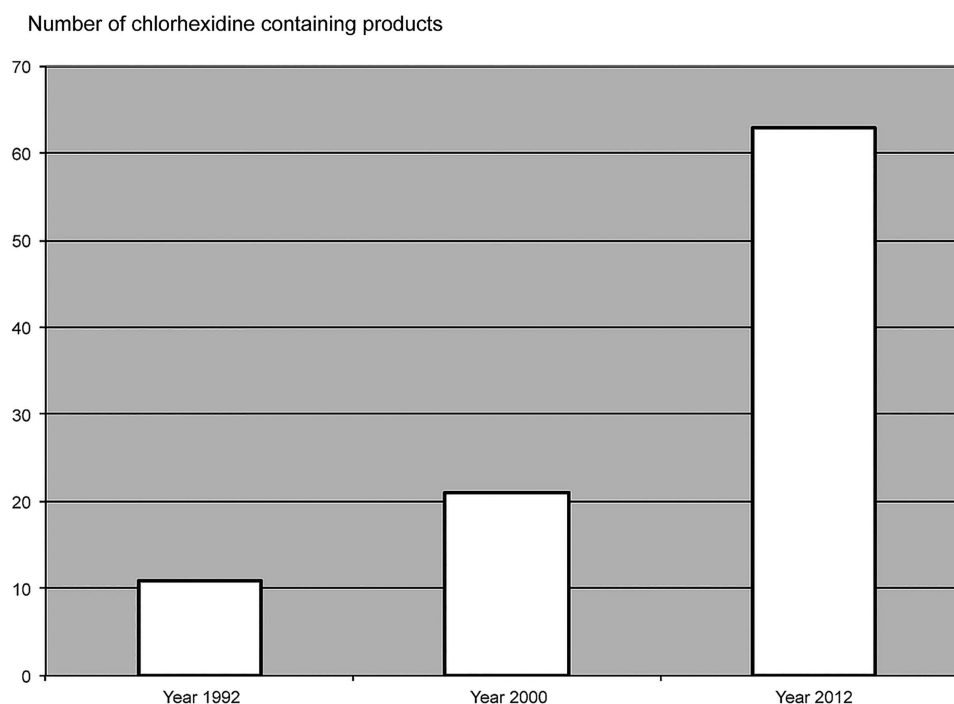


Figure 1 Bar chart demonstrating the increase in chlorhexidine containing products available.

component in its effectiveness, suggesting it is likely to be overlooked.¹⁵

Studies have demonstrated that the impregnation of catheters and central venous lines is more cost-effective and offers greater microbial resistance than non-coated lines.^{16 17} Reports of anaphylaxis from coated lines is well described in the literature.^{6 18–22} In 1998, the Food and Drug Administration issued a public health notice regarding potential hypersensitivity reactions to chlorhexidine-impregnated medical devices.²³ Fourteen years later the MHRA issued a patient safety alert on risks of

anaphylaxis from medical devices and medicinal products containing chlorhexidine.²⁴ This led to Japan withdrawing all chlorhexidine impregnated central venous lines.¹⁹

Delayed recognition of chlorhexidine as a cause of anaphylaxis also complicates management and resuscitation efforts. In 2001 Stephens *et al*²⁰ reported that two anaesthetists inserted a central venous line in a patient with known chlorhexidine allergy; they were unaware that the line was precoated. As a result the patient experienced severe anaphylaxis with prolonged resuscitation and subsequent intensive care admission. In

Table 1 Specific characteristics of case studies of chlorhexidine anaphylaxis in the last 5 years

Author(s)	Total number of cases	Sex	Age	Presentation: urticaria	Cardiovascular collapse	Respiratory compromise	History of cutaneous reactions	Confirmed: Skin tests	Specific IgE	History of atopy
Bae <i>et al</i> , 2008	1	M	54	Y	Y	N	N	Y	NR	N
Jee <i>et al</i> , 2009	4	NR	NR	Y	Y	N	NR	NR N=4)	Y (N=1)	NR
Parkes <i>et al</i> , 2009	3	M	33	Y	Y	N	NR	Y	NR	Y
		F	39	Y	Y	Y	Y	Y	NR	Y
		M	61	Y	Y	N	NR	Y	NR	N
Sivathanan and Goodfellow 2011	1	M	74	Y	Y	N	Y	NR	NR	N
Beatty <i>et al</i> , 2011	1	M	74	Y	Y	N	NR	Y	NR	N
Noel <i>et al</i> , 2012	1	M	67	Y	Y	N	Y	Y	NR	N
Nakonechna <i>et al</i> , 2012	6	M	50	Y	Y	N	NR	NR	Y	N
		M	78	Y	N	Y	Y	NR	Y	NR
		M	72	Y	Y	N	NR	Y	Y	N
		M	73	N	Y	N	Y	Y	Y	N
		M	73	Y	Y	Y	Y	Y	Y	N
		M	60	Y	N	N	Y	Y	Y	N
Guleri <i>et al</i> , 2012	3	M	71	Y	Y	N	Y	Y	Y	NR
		M	26	N	Y	N	Y	Y	Y	NR
		M	73	N	Y	N	Y	NR	Y	NR

NR, Not reported; Y, Yes; N, No.

2003, Kluger²¹ reported a similar occurrence. In this case, the labelling of the central venous line as a chlorhexidine-containing product was overlooked. This label was in small writing on the back of the packaging in contrast to the latex-free statement written in large and clear font on the front of the label.

Guidelines were published in 2009/2010 on anaphylaxis during general anaesthesia detailing its management by anaesthetists and investigation by allergists written by the Anaesthetic Association of Great Britain & Ireland (AAGBI)²⁵ and British Society of Allergy and Clinical Immunology,²⁶ respectively. These guidelines advise the consideration of chlorhexidine as a cause of anaphylaxis during general anaesthesia.

MECHANISM OF ANAPHYLAXIS

The structure of chlorhexidine is symmetrical with two identical epitopes (figure 2). Chlorhexidine does not directly release histamine and it does not activate Complement via either the classical or alternative pathways.^{1 9 27} The double epitope structure of chlorhexidine is thought to bind directly to two immunoglobulin E antibodies (IgE) resulting in the systemic activation of mast cells and subsequent release of cell mediators such as histamine, proteoglycans, leukotrienes and tryptase.²⁸ There are no known reports of cross reactivity between chlorhexidine and other antiseptic agents published.

CLINICAL PRESENTATION

Anaphylaxis to chlorhexidine appears to occur more frequently in men, with a mean age of presentation at 58 years (table 1). Where reported, many of these patients had previously experienced a cutaneous reaction on chlorhexidine exposure. However, in the last 4 years we have observed a surge in confirmed cases of anaphylaxis to chlorhexidine, with increasing numbers of female patients recently diagnosed. These patients rarely have history of atopic disease⁸ as supported in table 1, in contrast to latex allergy, which is often associated with atopy.²⁵ A reaction commonly occurs during surgery, a urological procedure, carotid catheterisation or central venous line insertion. Most cases present with cardio vascular collapse and nearly all patients (where reported) developed flushing/urticaria at the time of the reaction, while respiratory compromise is almost never reported.

Chlorhexidine-induced anaphylaxis is often very difficult to treat with prolonged treatment for refractory anaphylaxis requiring large doses of epinephrine.⁶ Slow recognition that a chlorhexidine-containing device may be the cause of the anaphylaxis prolongs the anaphylaxis. Moreover, devices are often placed intravenously or against mucosal surfaces and chlorhexidine binds covalently to proteins in the skin and mucosa, which is thought to contribute to a persisting antimicrobial effect.³⁶

INVESTIGATIONS

If a diagnosis of anaphylaxis is suspected, serum mast cell tryptase levels should be checked within 1 h of the event and then 2–4 h and 24 h or more after the event.³⁷ Checking at three time points increases the sensitivity of the test. Tryptase is a mast cell mediator released by mast cells in an allergic reaction.

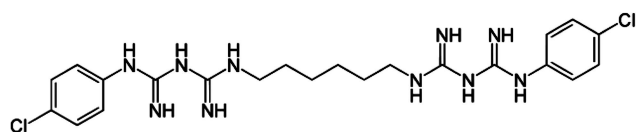


Figure 2 Chlorhexidine molecule.

If serum tryptase levels are still significantly raised 24 h later and are not falling this may indicate systemic mastocytosis. Serum specific IgE to chlorhexidine can also be checked immediately after a reaction.

The investigation of drug allergy is complex and all patients with a history of suspected allergy or anaphylaxis to chlorhexidine should be referred to a specialist allergy centre with expertise in drug allergy, a list of which is available on the AAGBI website. The information required when referring a patient includes the AAGBI 'allergies referral form' (available from the AAGBI website), serum tryptase results (if available), drug chart, hospital notes and surgical notes.

The allergist will perform skin prick testing to chlorhexidine to confirm the diagnosis alongside critically eliminating other drugs and agents as the cause of the reaction (figure 3). Referrals must be made promptly as these tests should ideally be performed after 4–6 weeks and within 3–7 months after a reaction, based on consensus rather than evidence base.^{9 18 38 39} Routine skin testing with chlorhexidine is not recommended as a negative skin test does not guarantee not having an allergic reaction in the future, and the clinical significance of a positive test in the absence of a clear history of anaphylaxis is uncertain. As with all drug allergies, the size of the skin test does not equate to the severity of the reaction.³⁷

CASE HISTORY

A retired 62-year-old man with a history of previous coronary artery bypass grafts and no history of atopy or drug allergy underwent a coronary angiogram. Midway through the procedure he developed urticaria, generalised erythema, nausea and hypotension and was treated with intravenous chlorpheniramine, hydrocortisone and gelofusine. It was assumed that the anaphylactic reaction was secondary to the radio contrast media *Omnipaque*.

Three days later he underwent a four vessel coronary artery bypass graft. Following routine induction a chlorhexidine coated central venous line was inserted and immediately his blood pressure fell from a baseline systolic of 170 mmHg to 30 mm Hg. Despite multiple boluses of epinephrine, norepinephrine and metaraminol, he remained hypotensive. The central venous line was removed and a non-chlorhexidine coated central venous line inserted and further epinephrine and hydrocortisone administered. Despite these actions, the patient's blood pressure and pulse became undetectable. External cardiac massage and a

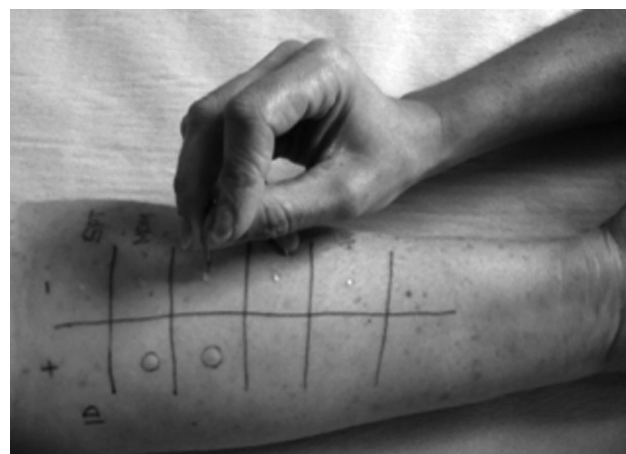


Figure 3 Performing skin testing.

Review

norepinephrine infusion were commenced, and once the patient was stabilised, he proceeded to surgery.

Exposure to latex and chlorhexidine were the only common agents in both anaphylactic reactions. During cardiac catheterisation the patient's groin was cleaned with 2% chlorhexidine. The second event occurred during insertion of a 2.43% chlorhexidine coated central venous line.

A skin prick test to latex was negative. Skin prick testing to chlorhexidine produced a 7×6 mm weal and 32×28 mm flare to 0.05% chlorhexidine (figure 4). Other skin tests eliminated any other causes. The patient was advised that he was allergic to chlorhexidine and should avoid all chlorhexidine containing products and obtain medical alert identification.

CLINICAL MANAGEMENT

Once there is a diagnosis of anaphylaxis to chlorhexidine, it is the responsibility of the healthcare professional to provide the patient with clear information about chlorhexidine avoidance. Empowering the patient by increasing awareness is essential since chlorhexidine is often hidden in products, knowledge of its existence by healthcare professionals is variable and information publically available is limited. Alerts must then be recorded in the patient's written and electronic records and the MHRA (UK) or relevant agencies in other countries notified.

There is no evidence to indicate that chlorhexidine allergy may resolve with time or by avoidance. Chlorhexidine desensitisation has not been attempted while desensitisation to penicillin/aspirin is well described. Latex immunotherapy has been trialled but the latest review in 2005 concluded that the risk of adverse events was unacceptable.⁴⁰

FOUR KEY POINTS

- ▶ All healthcare professionals should be aware that chlorhexidine has the potential to cause life-threatening allergic reactions
- ▶ Diagnosis of drug allergy is complex and therefore patients with presumed anaphylaxis should be referred to an allergy centre with expertise in the diagnosis and investigation of patients with anaphylaxis to drugs

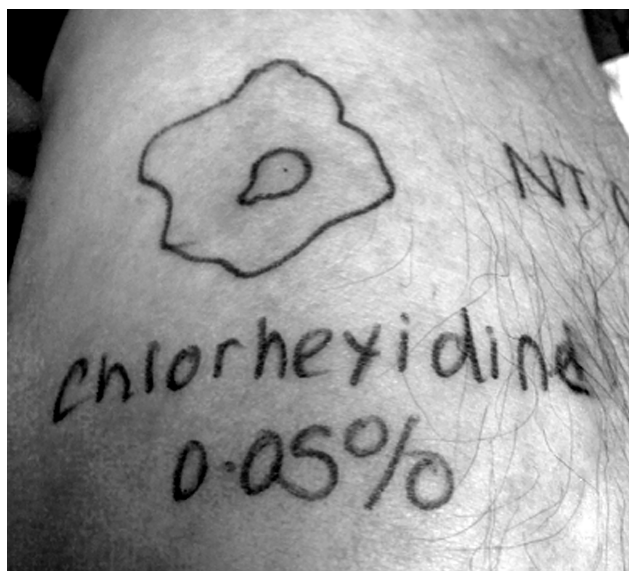


Figure 4 Result 6 h post skin test.

- ▶ If a patient is identified as allergic to chlorhexidine, avoidance information should be provided to the patient and healthcare workers to ensure that a chlorhexidine-free environment in the healthcare setting is safeguarded.
- ▶ The patient must be strongly encouraged to obtain alert identification and this information communicated to all healthcare workers involved in the patient's care

RISK TO HEALTHCARE WORKERS

It remains uncertain whether healthcare workers are at risk of sensitisation in view of some individuals being exposed to chlorhexidine on a daily basis. Two cases of occupational asthma in nurses caused by chlorhexidine and alcohol aerosols have been reported.⁴¹ The evidence from a small study in Denmark in 2003⁴² concluded this was likely to be rare. However, in 2009 a UK based study⁴³ distributed questionnaires to 86 healthcare workers (53 questionnaires were returned) in a district general hospital. Those who reported skin symptoms were referred to the immunology department for allergy assessment of which four cases of chlorhexidine allergy were identified in an endoscopy nurse, oncology nurse, theatre nurse and hospital domestic. This was based on clinical history, positive skin prick test and specific IgE, although none of these individuals had experienced anaphylaxis. In our clinical practice we are yet to see large numbers of healthcare workers being referred. However, in view of the widespread use of chlorhexidine and support by infection control, it is reasonable to question whether chlorhexidine allergy may become the new 'latex'; namely a healthcare related allergy with occupational implications.

CONCLUSION

Chlorhexidine allergy can initially present with mild cutaneous urticarial symptoms. This is often missed by clinicians, leaving patients at risk of life-threatening anaphylaxis on subsequent exposure. It is under-recognised as a cause of anaphylaxis in secondary care and should always be considered in perioperative anaphylaxis. Detailed history and diagnostic testing should be performed in a specialist allergy centre. In view of the widespread use of chlorhexidine, it is essential that healthcare workers are aware of its potential adverse reactions. Consideration should be given to developing ways of identifying patients at risk of chlorhexidine allergy and the routine use of these products may need to be reviewed.

Main messages

- ▶ Many central venous lines and catheters are coated with chlorhexidine.
- ▶ If a patient experiences an allergic reaction during any procedure, sensitivity to chlorhexidine should be considered.
- ▶ Chlorhexidine anaphylaxis is often associated with previous cutaneous reactions to chlorhexidine.
- ▶ A thorough clinical history and accurate record of events is essential before any diagnostic testing.
- ▶ Timed acute tryptase measurements should be taken less than 1 h after the episode of anaphylaxis, at 2–4 h and after 24 h.
- ▶ Investigations for sensitivity to chlorhexidine or any allergic reaction during a procedure should occur in specialist allergy centres.

Current research questions

- ▶ What is the actual incidence of chlorhexidine anaphylaxis worldwide?
- ▶ Will a multicentre investigation of chlorhexidine allergy in healthcare workers demonstrate an incidence equivalent or beyond latex allergy?

Key references

- ▶ Beaudouin E, Kanny G, Morisset M, *et al.* Immediate hypersensitivity to chlorhexidine: literature review. *Eur Ann Allergy Clin Immunol* 2004;36:123–6.
- ▶ Garvey LH, Kroigaard M, Poulsen LK, *et al.* IgE-mediated allergy to chlorhexidine. *J Allergy Clin Immunol* 2007;120:409–15.
- ▶ Harper NJN, Dixon T, Dugué P, *et al.* Suspected anaphylactic reactions associated with anaesthesia. *Anaesthesia* 2009;64:199–211.
- ▶ Ewan PW, Dugue P, Mirakian R, *et al.* BSACI guidelines for the investigation of suspected anaphylaxis during general anaesthesia. *Clin Exp Allergy* 2010;40:15–31.
- ▶ Mirakian R, Ewan PW, Durham SR, *et al.* BSACI guidelines for the management of drug allergy. *Clin Exp Allergy* 2009;39:43–61.

Self assessment questions

Please answer true (T) or false (F) to the below,

1. The MHRA (UK) issued a safety alert on risks of anaphylaxis from medical devices and medicinal products containing chlorhexidine?
2. The concentrations of chlorhexidine in use vary from 0.05% to 2.4%. (0.05–4%)
3. Most patients who experience anaphylaxis to chlorhexidine have a history of atopy
4. There is no known cross reactivity between associated chlorhexidine and other antiseptics
5. Chlorhexidine can be present in dressings

Acknowledgements The allergy team at St Mary's Hospital, Imperial College Healthcare NHS Trust, London

Contributors KMO is the first author of the review and case study, and obtained consent from the patient to publish the case report and image. SF acted as coauthor and supervisor.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Ohtoshi T, Yamauchi N, Tadokoro K, *et al.* IgE antibody-mediated shock reaction caused by topical application of chlorhexidine. *Clin Allergy* 1986;16:155–61.
- 2 Search Results—(eMC). 2013. <http://www.medicines.org.uk/emc/searchresults.aspx?term=chlorhexidine&searchtype=QuickSearch>. (accessed 6 Mar 2013)
- 3 BIRDWOOD B. Reaction to Chlorhexidine and Cetrimide. *Lancet* 1965;1:651–2.
- 4 Calnan CD. Contact dermatitis from drugs. *Proc R Soc Med* 1962;55:39–42.
- 5 Nishioka K, Doi T, Katayama I. Histamine release in contact urticaria. *Contact Dermatitis* 1984;11:191.
- 6 Beaudouin E, Kanny G, Morisset M, *et al.* Immediate hypersensitivity to chlorhexidine: literature review. *Eur Ann Allergy Clin Immunol* 2004;36:123–6.
- 7 Knight BA, Puy R, Douglass J, *et al.* Chlorhexidine anaphylaxis: a case report and review of the literature. *Intern Med J* 2001;31:436–7.
- 8 Krautheim AB, Jermann TH, Bircher AJ. Chlorhexidine anaphylaxis: case report and review of the literature. *Contact Dermatitis* 2004;50:113–6.
- 9 Garvey LH, Kroigaard M, Poulsen LK, *et al.* IgE-mediated allergy to chlorhexidine. *J Allergy Clin Immunol* 2007;120:409–15.
- 10 Koskeroglu N, Durmaz G, Bahar M, *et al.* The role of meatal disinfection in preventing catheter-related bacteriuria in an intensive care unit: a pilot study in Turkey. *J Hosp Infect* 2004;56:236–8.
- 11 Schiotz HA. Antiseptic catheter gel and urinary tract infection after short-term postoperative catheterization in women. *Arch Gynecol Obstet* 1996;258:97–100.
- 12 Webster J, Hood RH, Burrige CA, *et al.* Water or antiseptic for periurethral cleaning before urinary catheterization: a randomized controlled trial. *Am J Infect Control* 2001;29:389–94.
- 13 Caldeira D, David C, Sampaio C. Skin antiseptics in venous puncture-site disinfection for prevention of blood culture contamination: systematic review with meta-analysis. *J Hosp Infect* 2011;77:223–32.
- 14 Lee I, Agarwal RK, Lee BY, *et al.* Systematic review and cost analysis comparing use of chlorhexidine with use of iodine for preoperative skin antiseptics to prevent surgical site infection. *Infect Control Hosp Epidemiol* 2010;31:1219–29.
- 15 Maiwald M, Chan ES. The forgotten role of alcohol: a systematic review and meta-analysis of the clinical efficacy and perceived role of chlorhexidine in skin antiseptics. *PLoS ONE* 2012;7:e44277.
- 16 Shorr AF, Humphreys CW, Helman DL. New choices for central venous catheters: potential financial implications. *Chest* 2003;124:275–84.
- 17 Gaonkar TA, Sampath LA, Modak SM. Evaluation of the antimicrobial efficacy of urinary catheters impregnated with antiseptics in an in vitro urinary tract model. *Infect Control Hosp Epidemiol* 2003;24:506–13.
- 18 Oda T, Hamasaki J, Kanda N, *et al.* Anaphylactic shock induced by an antiseptic-coated central venous [correction of nervous] catheter. *Anesthesiology* 1997;87:1242–4.
- 19 Terazawa E, Shimonaka H, Nagase K, *et al.* Severe anaphylactic reaction due to a chlorhexidine-impregnated central venous catheter. *Anesthesiology* 1998;89:1296–8.
- 20 Stephens R, Mythen M, Kallis P, *et al.* Two episodes of life-threatening anaphylaxis in the same patient to a chlorhexidine-sulphadiazine-coated central venous catheter. *Br J Anaesth* 2001;87:306–8.
- 21 Kluger M. Anaphylaxis to chlorhexidine-impregnated central venous catheter. *Anaesth Intensive Care* 2003;31:697–8.
- 22 Jee R, Nel L, Gnanakumaran G, *et al.* Four cases of anaphylaxis to chlorhexidine impregnated central venous catheters: a case cluster or the tip of the iceberg? *Br J Anaesth* 2009;103:614–15.
- 23 Public Health Notifications (Medical Devices) >FDA Public Health Notice: Potential Hypersensitivity Reactions To Chlorhexidine-Impregnated Medical Devices. 2013. <http://www.fda.gov/medicaldevices/safety/alertsandnotices/publichealthnotifications/ucm062306.htm>. (accessed 6 Mar 2013).
- 24 Medical Device Alert: All medical devices and medicinal products containing chlorhexidine (MDA/2012/075). 2013. <http://www.mhra.gov.uk/Publications/Safetywarnings/MedicalDeviceAlerts/CON197918> (accessed 6 Mar 2013).
- 25 Harper NJN, Dixon T, Dugué P, *et al.* Suspected anaphylactic reactions associated with anaesthesia. *Anaesthesia* 2009;64:199–211.
- 26 Ewan PW, Dugue P, Mirakian R, *et al.* BSACI guidelines for the investigation of suspected anaphylaxis during general anaesthesia. *Clin Exp Allergy* 2010;40:15–31.
- 27 Layton GT, Stanworth DR, Amos HE. The incidence of IgE and IgG antibodies to chlorhexidine. *Clin Exp Allergy* 1989;19:307–14.
- 28 Pham NH, Weiner JM, Reisner GS, *et al.* Anaphylaxis to chlorhexidine. Case report. Implication of immunoglobulin E antibodies and identification of an allergenic determinant. *Clin Exp Allergy* 2000;30:1001–7.
- 29 Bae YJ, Park CS, Lee JK, *et al.* A case of anaphylaxis to chlorhexidine during digital rectal examination. *J Korean Med Sci* 2008;23:526–8.
- 30 Parkes AW, Harper N, Herwadkar A, *et al.* Anaphylaxis to the chlorhexidine component of Instillagel: a case series. *Br J Anaesth* 2009;102:65–8.
- 31 Sivathasan N, Goodfellow PB. Skin cleansers: the risks of chlorhexidine. *J Clin Pharmacol* 2011;51:785–6.

Review

- 32 Beatty P, Kumar N, Ronald A. A complicated case of chlorhexidine-associated anaphylaxis. *Anaesthesia* 2011;66:60–1.
- 33 Noel J, Temple A, Laycock GJ. A case report of anaphylaxis to chlorhexidine during urinary catheterisation. *Ann R Coll Surg Engl* 2012;94:e159–60.
- 34 Nakonechna A, Dore P, Dixon T, *et al.* Immediate hypersensitivity to chlorhexidine is increasingly recognised in the United Kingdom. *Allergol Immunopathol (Madr)* 2012;19.
- 35 Guleri A, Kumar A, Morgan RJ, *et al.* Anaphylaxis to chlorhexidine-coated central venous catheters: a case series and review of the literature. *Surg Infect (Larchmt)* 2012;13:171–4.
- 36 Lim KS, Kam PC. Chlorhexidine--pharmacology and clinical applications. *Anaesth Intensive Care* 2008;36:502–12.
- 37 Mirakian R, Ewan PW, Durham SR, *et al.* BSACI guidelines for the management of drug allergy. *Clin Exp Allergy* 2009;39:43–61.
- 38 Moneret-Vautrin DA, Laxenaire MC, Moeller R. Anaphylaxis due to succinylcholine. Immunoallergological study of thirteen cases. *Clin Allergy* 1981;11:175–83.
- 39 Brockow K, Romano A, Blanca M, *et al.* General considerations for skin test procedures in the diagnosis of drug hypersensitivity. *Allergy* 2002;57:45–51.
- 40 Rolland JM, Drew AC, O'Hehir RE. Advances in development of hypoallergenic latex immunotherapy. *Curr Opin Allergy Clin Immunol* 2005;5:544–51.
- 41 Wacławski ER, McAlpine LG, Thomson NC. Occupational asthma in nurses caused by chlorhexidine and alcohol aerosols. *BMJ* 1989;298:929–30.
- 42 Garvey LH, Roed-Petersen J, Husum B. Is there a risk of sensitization and allergy to chlorhexidine in health care workers?. *Acta Anaesthesiol Scand* 2003;47:720–4.
- 43 Nagendran V, Wicking J, Ekbote A, *et al.* IgE-mediated chlorhexidine allergy: a new occupational hazard?. *Occup Med (Lond)* 2009;59:270–2.

Answers

1. True
2. False
3. False
4. True
5. True



Chlorhexidine: an unrecognised cause of anaphylaxis

Katy Mara Odedra and Sophie Farooque

Postgrad Med J 2014 90: 709-714 originally published online October 28, 2014

doi: 10.1136/postgradmedj-2013-132291

Updated information and services can be found at:
<http://pmj.bmj.com/content/90/1070/709>

These include:

References

This article cites 39 articles, 5 of which you can access for free at:
<http://pmj.bmj.com/content/90/1070/709#BIBL>

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:
<http://group.bmj.com/subscribe/>