

Management of anaphylaxis in the dental practice: an update

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Key points

Anaphylaxis is a life-threatening emergency and the incidence is on the increase.

Adrenaline needs to be administered promptly to optimise survival.

GDPs need to be competent at administering adrenaline intramuscularly using a syringe and needle.

Abstract

Anaphylaxis is a severe and potentially life-threatening allergic reaction that can occur in the dental practice. There are a number of dental-related causes including mouthwashes, local anaesthetics, latex and antibiotics. The dental team must be able to respond effectively and manage the life-threatening situation appropriately following Resuscitation Council UK guidelines. The timely administration of adrenaline is life-saving; any delays can lead to a poor outcome. With the current national supply issues with adrenaline auto-injector devices, there is an expectation that GDPs should be competent at drawing up adrenaline from an ampoule and administering it intramuscularly. The aim of this article is to provide an update on the management of anaphylaxis in the dental practice with particular reference to the procedure for intramuscular injection of adrenaline.

Introduction

Anaphylaxis is a severe and potentially life-threatening allergic reaction¹ which could occur in the dental practice.² The GDC states that 'all registrants must be trained in dealing with medical emergencies, including resuscitation, and possess up-to-date evidence of capability'.³ The dental team must be able to manage anaphylaxis effectively following Resuscitation Council UK guidelines.⁴

The prompt administration of adrenaline is pivotal to a favourable outcome. However, due to the ongoing supply issues and product recalls relating to adrenaline auto-injector devices (AAs),^{5,6,7,8} those who previously relied on using these simple devices now need to be competent at intramuscular (IM) injection of adrenaline using a

syringe and needle, a nationally expected requirement.^{9,10}

The aim of this article is to provide an update on the management of anaphylaxis in the dental practice.

Definition

Anaphylaxis is a severe, potentially life-threatening generalised allergic reaction characterised by rapidly developing symptoms and signs including skin changes (such as redness and itching), mucosal changes (swelling below the skin surface), swallowing and breathing difficulties (due to swollen mouth, throat or tongue), wheezing, tachypnoea, tachycardia and hypotension.¹¹

Incidence

The incidence of anaphylaxis in the UK is increasing, with a reported increase in hospital admissions for anaphylaxis from one to seven cases per 100,000 population per year between 1992 and 2012.¹² This 700% increase is fortunately not associated with an increase in mortality rates, which are still very rare – approximately 20 in the UK every year.⁴

Causes of anaphylaxis in dental practice

Antibiotics

Antibiotics are among the drugs most likely to cause anaphylaxis.¹³ Amoxicillin, phenoxymethylpenicillin and metronidazole are three antibiotics that are prescribed in dentistry.¹⁴ Amoxicillin is probably the one most commonly associated with anaphylaxis. Deaths from anaphylactic reactions to amoxicillin have been reported.¹⁵

Antibiotics are the main cause of perioperative anaphylaxis in the UK, being responsible for almost 50% of cases with an incidence of 4.0 per 100,000 administrations.¹⁶ One recent study in France identified 17 cases of anaphylaxis to amoxicillin administered for dental procedures.¹⁷

Chlorhexidine

Chlorhexidine is an effective antiseptic which is widely used in dentistry,¹⁸ being present in a number of dental products including some mouthwashes, toothpastes and dental implants.^{19,20} However, anaphylaxis to chlorhexidine has been increasingly reported worldwide, including two incidents in the UK where chlorhexidine-containing

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Table 1 Products in the dental practice containing latex and latex-free alternatives⁴⁴

Examples of dental equipment that may contain NRL	NRL-free alternative	Manufacturer
Amalgam carriers	Teflon amalgam carriers	Austinell
Aspirators	Yankauer plastic wide-bore	Tyco-Healthcare Durr
Bunsen burner tubing	Heating device	
Dental dam	Roeko flexi-dam Hygenic non-latex	FE Cardozo Ltd Coltene/Whaledent
Hygenic Wedjets (dental dam stabilising cord)	Not currently available	
Endodontic* stops	Silicone stops	QED
Elastics (orthodontic)	GAC ELF Latex-Free elastics	Orthocare TOC (The Orthodontic Co.)
Mixing bowls** (eg alginate bowls)	NRL-free bowls	Dentsply
Polishing equipment	Prophy cups, prophy heads Disposable prophy angle to be used on nosecone of doriot-style handpiece	Young Dental W+H Dental (UK) Ltd
	Enhance polishing cups	Dentsply
	Shofu Greenie & Brownie polishing points	Minerva
Temporary crowns and matrices	Directa crowns (polycarbonate) Odus cervical matrizia Odus Pella Crown Form	Tower Dental Hawes Neos Austinall

Key:

NRL = natural rubber latex

* = endodontic stop is a rubber stop on the hand files / rotary files that are used during root canal treatment and assists in the measuring of canals

** = Mixing bowls (it should read 'e.g. alginate bowls')- these are bowls in which the alginate impression material is hand mixed

mouthwash had been used to irrigate tooth sockets following a recent tooth extraction;¹⁸ unfortunately, the resulting anaphylaxis resulted in the death of both patients.^{21,22}

A national report²³ investigating 266 cases of anaphylaxis in the perioperative period in UK hospitals found that chlorhexidine was:

- The cause in nearly 10% of the cases
- The third most common cause of anaphylaxis
- Estimated to have an incidence of 0.78 per 100,000 exposures.

Interestingly, the authors also found that three cases could potentially have been avoided by better history-taking or by heeding a relevant history.²³

A Medicines and Healthcare products Regulatory Agency (MHRA) alert in 2014²⁰ raised awareness about the risk of anaphylaxis to products containing chlorhexidine. The continued use of chlorhexidine as an irrigation solution for treating an established dry socket has been questioned.¹⁸ The SDCEP²⁴ advises to consider saline to irrigate a dry socket because of the associated risks of anaphylaxis when using chlorhexidine and the lack of evidence to support its use. The latest advice during the COVID-19

pandemic advises patients to rinse with warm saltwater should the GDP suspect dry socket.²⁵

Local anaesthetic

Anaphylactic reactions to local anaesthetic (LA) administered in the dental setting is very rare,²⁶ but they have been reported.^{27,28,29} The actual incidence of adverse effects from LA is about 0.1–1%,³⁰ with 1% of these cases being confirmed allergic reactions.^{26,31} Actual allergic reactions to LAs are either immediate hypersensitivity reactions (type I: systemic signs) or delayed hypersensitivity reactions (type IV: localised reaction at the injection site, contact dermatitis).²⁶

Amide LA agents (for example, lignocaine) are most commonly used in dentistry, but allergic reactions are very rare.²⁶ The least allergenic amide LA agents are mepivacaine and plain prilocaine.³² Allergic reactions are more common with ester LA agents because they are metabolised to para-aminobenzoic acid, a known allergenic compound.³³ Benzocaine is the only ester LA used in dentistry (topical preparations applied before administration of LA).²⁶

Many LA-induced allergic reactions are due to other constituents in the injection solution

rather than to the drug itself.²⁶ Excipients such as preservatives (for example, benzoates used in multi-dose vials) and antioxidants (for example, metabisulphites used in LA solutions containing adrenaline) can cause allergic reactions.^{27,33,34}

It is also important to be aware of the risk of allergy to natural rubber latex (NRL) contained in bungs, gloves and dams, as well as other dental materials²³ (see below). Contrary to some reports, the risk of latex allergies from LA carriages is minimal.³⁵

Following administration of an LA, a few patients may suffer one of a range of unwanted symptoms which sometimes can be mistaken for allergic reactions and patients may be unnecessarily told they are allergic to the anaesthetic.²⁶ Most adverse reactions are psychogenic or vasovagal.³⁶

General anaesthetic

Anaphylaxis to anaesthetic drugs is not uncommon.¹⁶ There have been a number of cases in oral surgery theatres that have been reported.³⁷

Latex

Allergy to NRL (latex) became increasingly common towards the end of the last century

Table 2 Recognition of anaphylaxis using the ABCDE approach: signs and symptoms that may be present^{4,53}

ABCDE	Signs and symptoms
Airway	Swollen tongue Difficulty swallowing/speaking Throat tightness Hoarse voice Stridor
Breathing	Difficult or noisy breathing Chest tightness Persistent coughing Wheeze Tachypnoea
Circulation	Hypotension Tachycardia Pallor Collapse
Disability	Feeling dizzy or faint Confusion Agitation Syncope Loss of consciousness
Exposure	Skin changes: urticarial, angioedema and erythema Rhinitis and conjunctivitis Abdominal pain/cramps Nausea and vomiting Diarrhoea Sense of impending doom

(partly due to increased use of latex gloves in healthcare settings), though it is now on the decline.³⁸ It is estimated that approximately 1–6% of the UK’s population have a latex allergy.^{35,39} Worldwide, reported data suggest that the average prevalence of latex allergy remains 9.7%, 7.2% and 4.3% among healthcare workers, susceptible patients and the general population, respectively.⁴⁰

At-risk groups include spina bifida patients (67% chance of latex allergy), healthcare professionals, and patients with an existing allergy to Elastoplast and certain foods (particularly banana, kiwi and avocado).^{38,41} Latex allergy-induced anaphylaxis is more likely to be severe in patients with uncontrolled asthma.³⁸

Although an allergy to latex is relatively common and may cause severe reactions,⁴² latex allergy-induced anaphylaxis is extremely rare.³⁹ A review of the literature found only one case report in the last 20 years of latex-induced anaphylaxis in the dental practice – a patient who had a reaction to a rubber dam.⁴³ Interestingly, a recent study examining 266 cases of perioperative anaphylaxis reported no cases were due to latex.¹⁶

Even rarer is fatal anaphylaxis due to a latex allergy, with only isolated case reports being found in the literature⁴² and none related to dentistry. The dental team will be aware of the importance of using latex-free products

whenever possible and be alert to patients with latex allergies. Anaphylaxis Campaign has produced helpful guidance raising awareness of the presence of latex in dental products and listing latex-free alternatives (Table 1).⁴⁴

The incidence of latex allergy among healthcare workers is higher than in the general population,^{28,40,45} emphasising the importance for all dental team members to be particularly vigilant.³⁵ The incidence of latex allergy in the workplace among healthcare workers is one that is clearly addressed in several specific areas of health and safety legislation.⁴⁶

Toothpastes

Allergic reactions to toothpaste, including anaphylaxis⁴⁷ and even fatal anaphylaxis, have been reported.⁴⁸ In the US, a young person with a known dairy product allergy developed anaphylaxis and died after using a toothpaste containing Recaldent (a milk-derived protein) which had been recommended by her dentist.⁴⁹

A similar case was reported recently in Australia where a child with a milk allergy developed anaphylaxis after a ‘tooth mousse’ containing Recaldent was used during dental treatment.⁵⁰ The child began to complain of discomfort in her mouth, which progressed to difficulty swallowing which prompted her alert mother to administer her AAI immediately.⁴⁹

Iodoform

Iodoform is in a number of endodontic products⁵¹ including Alvogyl.⁵² Alvogyl’s product information stipulates that it shouldn’t be used in patients with known allergies to procaine (novocaine)-type anaesthetic, iodine or compounds related to iodine.⁵² The authors are aware of two anecdotal reports of anaphylaxis to Alvogyl; in one case, the GDP discovered after the event that the patient was allergic to iodine.

Clinical features and diagnosis

The lack of a consistent clinical picture can sometimes make an accurate diagnosis difficult.⁴ Anaphylaxis is characterised by quick onset and rapid deterioration. As soon as possible, a detailed history should be taken and the patient assessed (and treated) following the ABCDE approach (Table 2) to help in the recognition and initial diagnosis of anaphylaxis.

In a study of 593 cases of anaphylaxis, the most common findings were urticaria (Fig. 1) and angioedema (87%), shortness of breath/wheeze (59%) and symptoms of hypotension (33%).⁵³

It is more likely to be anaphylaxis if all three of the following criteria are met:⁴

1. Sudden onset and rapid progression of symptoms
2. Life-threatening airway and/or breathing and/or circulation problems
3. Skin and/or mucosal changes (flushing, urticaria, angioedema).

Mistaken diagnosis

It is possible to mistake a panic attack or a vasovagal attack for anaphylaxis. Following the familiar ABCDE approach (Table 2) will help to distinguish between a panic attack and vasovagal syncope from anaphylaxis:

- Panic attack: hyperventilation, tachycardia and anxiety-related erythematous (red) rash. The absence of urticaria, hypotension, pallor and dyspnoea helps to exclude anaphylaxis
- Vasovagal syncope: pallor, sweating, hypotension, nausea, vomiting and bradycardia. The absence of a rash, tachycardia and dyspnoea helps to exclude anaphylaxis.

Adrenaline

Adrenaline remains the most important drug in anaphylaxis, but to be effective, it

needs to be administered promptly. Delays in administering adrenaline increases the risk of death^{54,55} and failure to give adrenaline is the most common cause of death associated with anaphylaxis.⁵⁶ A study of the UK registry found that, in almost 40% of all deaths due to anaphylaxis, adrenaline had not been administered.⁵⁷

Actions

Adrenaline:

- Reverses peripheral vasodilation
- Reduces oedema
- Dilates the airways
- Increases myocardial contractility
- Suppresses histamine and leukotriene release.

Dose

The recommended⁴ doses of adrenaline are as follows:

- Adults: 500 micrograms IM (0.5 ml of 1:1,000)
- Child >12 years: 500 micrograms IM (0.5 mL)
- Child 6–12 years: 300 micrograms IM (0.3 ml of 1:1,000)
- Child <6 years: 150 micrograms IM (0.15 ml of 1:1,000).

The dose can be repeated at five-minute intervals until there has been an adequate response.¹¹

Route

Adrenaline should be administered intramuscularly, ideally into the anterolateral aspect of the middle third of the thigh.¹¹

Injections through clothing

IM injections should ideally be administered into the bare leg. This may prove difficult in the dental practice if the patient is wearing clothing that is difficult to remove quickly or indeed is reluctant to be exposed.

AAIs can be administered through light clothing.^{58,59,60} This sensible and practical advice enables the prompt administration of adrenaline which otherwise could be delayed if the patient had to undress first to expose the leg. Sometimes, other injections (for example, insulin) are advocated to be administered through clothing.

The authors are aware of a number of anecdotal reports of adrenaline injections routinely administered through clothing in emergency departments without any difficulties



Fig. 1 Urticaria (image courtesy of James Halpern, consultant dermatologist)

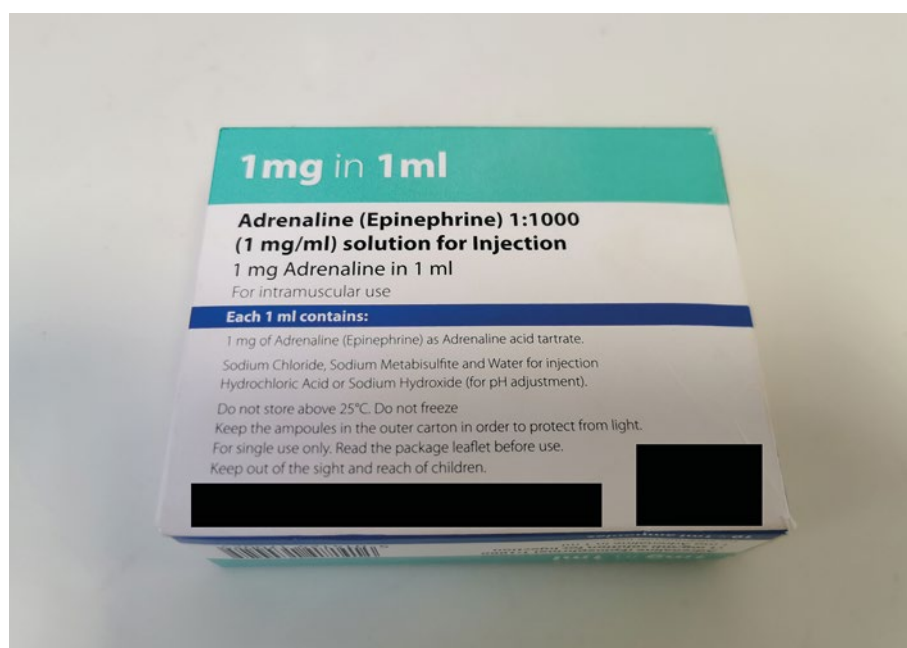


Fig. 2 Adrenaline 1:1,000 ampoules (box of ten)

and in fact this technique is recommended by some.⁶¹ It would therefore seem reasonable to consider this technique in a life-threatening, time-critical anaphylaxis situation in a dental practice if the patient is wearing light clothing, taking care to avoid the seam in the trousers and items in the patient's pocket.

Allergy to adrenaline

A question often asked is whether the patient can be allergic to the adrenaline injection.⁶² The answer is yes, but it is very rare and is usually due to hypersensitivity to sodium metabisulphite,⁶³ a preservative which is found in adrenaline 1:1,000 solution (product

literature) and in all three adrenaline self-injector devices prescribed in the UK (as well as in some drinks and food products).⁶⁴

Adrenaline should still be administered to a patient in anaphylaxis who has hypersensitivity to sodium metabisulphite, as the need for the life-saving drug far outweighs any theoretical risk from sulphites.^{64,65}

Adrenaline in dental medical emergency drugs kits

Adrenaline auto-injectors

Many dental practices stock AAIs in their medical emergency drugs kit. The AAIs



Fig. 3 Adrenaline 1:1,000 ampoule



Fig. 4 IM injection – insert needle at 90 degrees

currently available in the UK are Emerade, EpiPen and Jext, which are designed for self-use.⁶⁶ The obvious perceived advantages of AAIs are that they are quick and relatively easy to use. If an AAI is used, it is important to follow the manufacturer's guidelines for its use, taking particular care to avoid accidental self-injection which has been reported.⁶⁶

However, key concerns have been raised in the last two years concerning AAIs:

- Ongoing supply issues
- Recalls for Emerade following failed activations
- EpiPen 300 mcg device: needle length alleged to be too short for IM use in adults⁶⁷ (same will also apply to Jext)
- EpiPen 300 mcg device: incorrect dose of adrenaline in adults⁶⁷ (same will also apply to Jext).

The AAI supply issues led to the Chief Dental Officer for England (CDO) requesting

dental practices that stock AAIs in their medical emergency drugs kit to renew them with adrenaline ampoules, in order to preserve national stocks of the devices.⁹ Also, both the CDO⁹ and the Department of Health¹⁰ stipulate that all healthcare professionals providing services where anaphylaxis treatment may be required (for example, dentistry) should have the competency to draw up and administer IM adrenaline from ampoules with a normal syringe and needle.

The Resuscitation Council UK has reiterated that, in anaphylaxis, healthcare professionals should be administering the recommended dose of adrenaline in anaphylaxis; that is, 500 mcg for a patient over 12 years of age (an AAI should only be used if it is the only available adrenaline preparation when treating anaphylaxis in a healthcare setting).⁶⁸

Adrenaline 1:1,000

If not already, it is expected that dental practices will start stocking adrenaline 1:1,000 (1 mg/ml) ampoules (Fig. 2) in their emergency drugs kit (adrenaline 1:1,000 prefilled syringes are also available and are preferred by some to negate the need to draw up from an ampoule,⁶⁸ though the authors are aware of recent supply issues with this product as well).

Dental practices are advised to follow Public Health England's⁶⁹ guidelines, ensuring the following are available:

- Adrenaline 1:1,000 (1 mg/ml) ampoules x2 (usually come in a box of ten)
- Blue 23G 25 mm needles x4
- Graduated 1 ml syringes x4.

The recommended needle length for IM injections is 25 mm (a blue 23G 25 mm needle) for all ages to ensure that the drug is injected into the muscle; a longer 21G 38 mm needle may be needed in some adults.⁴ Safety needles should ideally be used for IM injections to reduce the risk of needle-stick injury.⁷⁰

Suggested procedure for IM injection of adrenaline

Which muscle?

IM injection into the vastus lateralis muscle (thigh) is advised because a high drug plasma level can be achieved within minutes.^{4,71} This is the ideal route.¹¹

Although in the dental practice, the deltoid muscle (arm) is usually easier to access, the rate of absorption of adrenaline from this site is slower compared to the recommended

vastus lateralis muscle.⁷² The deltoid muscle is therefore not routinely recommended,⁴ though it may need to be considered in a desperate situation.¹¹

IM injections in the thigh: recent changes in advice

- Wearing gloves routinely is not necessary,⁷³ although dental staff will probably already be wearing them
- Routinely using an ‘alcohol swab’ to clean the skin is no longer deemed necessary⁶⁹
- Leaving a small gap between the skin and the hub of the needle in case the needle breaks off during the injection is no longer advocated,⁷¹ as this may result in the drug being injected into subcutaneous fat, not muscle⁷²
- Aspirating or drawing back on a syringe to check if the needle is in a blood vessel is no longer advised for IM injections in the thigh⁶⁹
- Massaging the site following the injection is no longer advocated because it may disperse the drug out of the muscle tissue.^{74,75}

Opening the glass adrenaline ampoule

Before opening the ampoule, it may be necessary to gently tap the top to disperse any remnants of the drug back to the bottom. Cuts and lacerations can occur when opening glass ampoules,⁷⁶ particularly if the glass ampoule shatters due to too much pressure being applied. To minimise the risk of injury:⁷⁷

- Ideally, use a paper towel, piece of gauze or similar to protect the fingers and thumbs. Alternatively, use an ampoule-opening device
- Only apply pressure to the ‘neck’ of the ampoule
- Always apply pressure away from the coloured dot (Fig. 3) and never in any other direction
- Apply sufficient light pressure to ‘snap’ the top off the ampoule
- Don’t apply any pressure to the base of the ampoule as this will probably cause it to shatter
- Avoid pulling or twisting actions while applying pressure on the glass ampoule.

If the glass does shatter, then the broken glass and contents will need to be carefully discarded and another ampoule used.

Procedure for IM injection

The suggested procedure for IM injection below is a practical modification of the

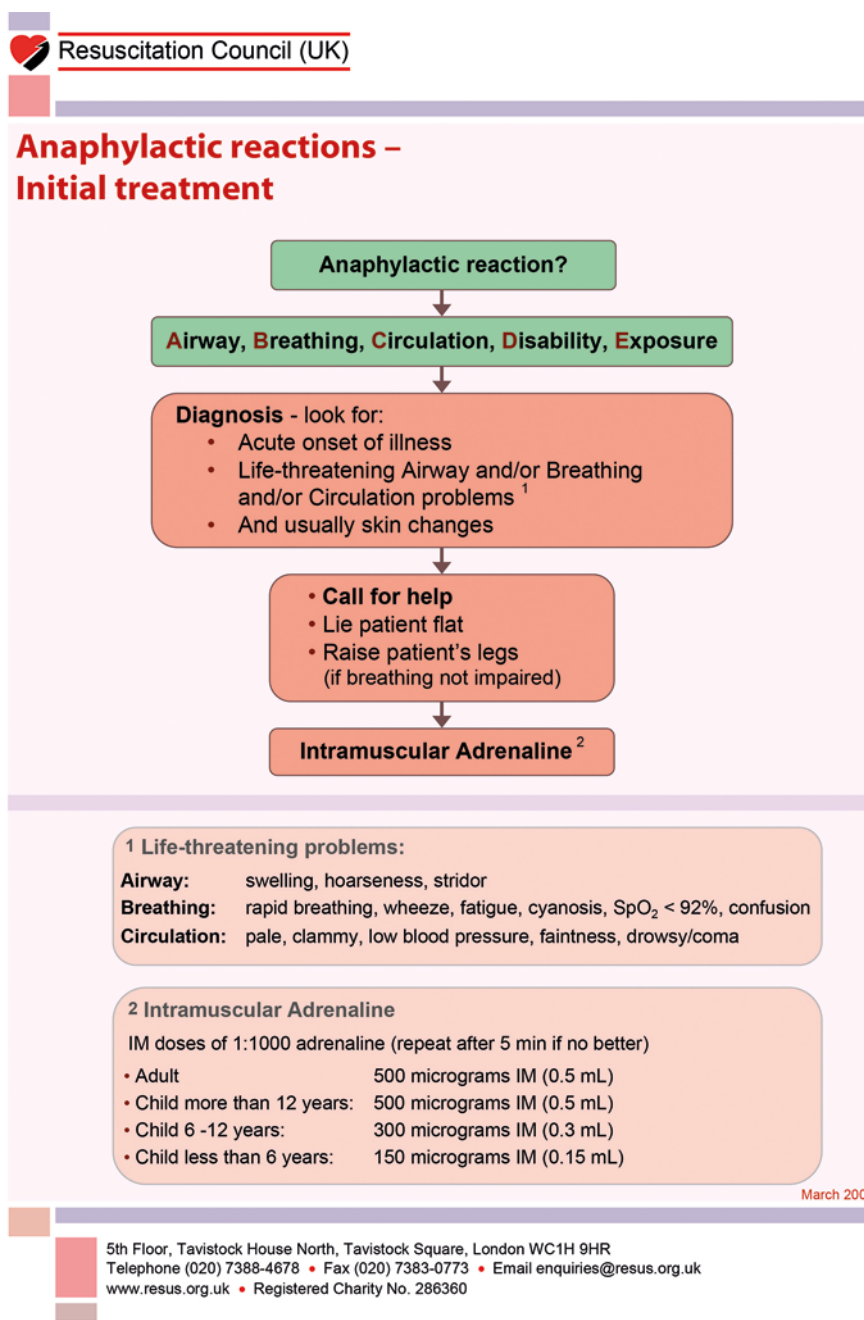


Fig. 5 Initial management of anaphylaxis, reproduced with kind permission from the Resuscitation Council (UK)⁴

ideal procedure described comprehensively elsewhere, reflecting the urgency of the life-threatening situation and the need to administer adrenaline without delay in order to save life:

- Advise the patient of the urgency of the situation and that the adrenaline injection is required
- Ask colleagues to prepare the patient; for example, expose the thigh if able. If not possible, plan to inject through light clothing

- Draw up the required dose of adrenaline. Assemble the syringe and needle, safely open the adrenaline 1:1,000 ampoule (see above) and withdraw the required amount of drug (see above) from the ampoule; if present, quickly expel any large air bubbles
- Change needle (ideally now use a safety needle),⁷⁰ dispose of used needle in sharps container, and take syringe and needle in a tray to the patient
- Use non-dominant hand to taut the skin (trickier to do this through clothing)

Box 1 SBAR communication tool for use in healthcare settings

Situation

Background

Assessment

Recommendation

Information derived from:⁷⁸

to displace subcutaneous tissue at injection site

- Advise patient to tense opposite leg (a distraction technique which also helps to relax the leg being used)
- Insert the needle at 90-degree angle using a dart-like action⁷¹ and inject the adrenaline (Fig. 4)
- Wait for two seconds (allows the drug to diffuse into the tissue)⁷⁵
- Withdraw the needle rapidly and dispose of sharps safely
- Draw up another dose of adrenaline in case it is required.

Management

The Resuscitation Council UK algorithm for initial treatment of anaphylaxis is depicted in Figure 5. The management of suspected anaphylaxis is:

- Call for help from colleagues and request the emergency drugs, oxygen and resuscitation kit
- Assess the patient following the ABCDE approach
- If anaphylaxis is suspected, call 999 for an ambulance and state anaphylaxis;¹¹ communicate effectively following SBAR⁷⁸ (Box 1)
- Immediately stop the dental procedure, clear the airway of any materials and remove any contact of likely triggering agent from the patient⁷⁹
- Ensure the patient is in a comfortable position; patients with airway and breathing difficulties may prefer to sit up, while those with hypotension usually benefit from lying down with legs raised⁴
- Administer oxygen 15 litres/min through a non-rebreather oxygen mask (if available, establish oxygen saturation monitoring using a pulse oximeter)
- For severe reactions where there are life-threatening airway and/or breathing and/or circulation problems (that is, hoarseness, stridor, severe wheeze, cyanosis, pale, clammy, drowsy, confusion

or coma), administer IM adrenaline 500 mcg⁴

- Closely monitor the patient following the ABCDE approach
- Repeat IM adrenaline at five-minute intervals until there has been an adequate response¹¹
- Do not sit the patient up or stand them up if they are feeling faint or dizzy – they may be in profound shock and may then have a cardiac arrest.⁸⁰

Debrief

A debrief should be planned and undertaken following any medical emergency to learn from the incident in order to try and improve for next time. A significant event analysis should also be done, but is probably best undertaken at a later date.

Documentation

Accurate record keeping will be expected.^{3,81} When able to do so, record the circumstances immediately before the onset of symptoms to help to identify the possible trigger of the anaphylactic reaction, the acute clinical features of the suspected anaphylactic reaction and the time of onset of the reaction.¹¹

Reporting obligations

Anaphylaxis suspected to be related to a medication should be reported to the MHRA⁸² using the yellow card system. Fatal anaphylaxis in a dental practice may need to be reported to the CQC.⁸³

Conclusion

Anaphylaxis can be life threatening. This article has described the management of anaphylaxis in the dental practice following Resuscitation Council UK guidelines, with particular reference to how to administer an IM injection.

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