

# Anaphylactic shock management in dental clinics: An overview

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## ABSTRACT

Anaphylaxis is among the emergency clinical events specifically related to local anaesthesia, leading to morbidity and mortality. Hence, our aim is to update knowledge of dental professionals about management of this entity with appropriate emergency management, by giving proper pharmacotherapy to prevent further auto immune reaction thus, saving their lives.

**Key words:** Adrenaline, allergens, anaphylaxis, lignocaine

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## INTRODUCTION

Anaphylaxis is defined as “an acute, potentially life-threatening hypersensitivity reaction, involving the release of mediators from mast-cells, basophils and recruited inflammatory cells. Anaphylaxis is defined by a number of signs and symptoms, alone or in combination, which occur within minutes, or up to a few hours, after exposure to a provoking agent. It can be mild, moderate to severe, or severe. Most cases are mild but any anaphylaxis has the potential to become life-threatening” (World Allergy Organization). Anaphylaxis develops rapidly, usually reaching peak severity within 5-30 min, and may, rarely, last for several days. All dental practitioners should be aware of the diagnosis and management of emergencies such as anaphylaxis that may arise from the use of local anesthetic agents in their clinical set up. Resuscitative drugs such as antihistamine, adrenaline and corticosteroids should be available at chair side for immediate use. All patients must be warned prior to local anesthetic agent administration of the possible danger that follows its use. They should be told to report back immediately to the clinic if a rash should develop.<sup>[1]</sup> Anaphylaxis may develop immediately and is usually immediately life-threatening due to respiratory

embarrassment. Early symptoms and signs include a sensation of warmth, itching especially in the axilla and groin, and a feeling of anxiety and panic. These may progress into an erythematous or urticarial rash, edema of the face and neck, bronchospasm and laryngeal edema.

## RISK FACTORS

- Known allergies.
- Cardiovascular disease.
- Substance abuse.
- Asthma and other respiratory diseases.
- Initial exposure to the allergen by injection (intravenous [IV] medication).
- Frequent exposure to the allergen, particularly if exposure is followed by a long delay and then a re-exposure.
- Low vitamin D levels.<sup>[2]</sup>

## TREATMENT IN AN EMERGENCY

### Rapid assessment

Airway: Look for and relieve airway obstruction; call for help early if there are signs of obstruction. Remove any traces of allergen remaining. Give high-flow oxygen using a mask with an oxygen reservoir.

Breathing: Look for and treat bronchospasm and signs of respiratory distress.

Circulation: Colour, pulse and blood pressure (BP).

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**Disability:** Assess whether responding or unconscious.

**Exposure:** Assess skin with adequate exposure, but avoid excess heat loss. Consider anaphylaxis when there is compatible history of rapid onset of severe allergic-type of reaction with respiratory difficulty and/or hypotension, especially if there are skin changes present [Figure 1].

## DISABILITY MANAGEMENT

Lie the patient flat: Raise the legs (care, as this may worsen any breathing problems). In pregnant patients, use a left lateral tilt of at least 15°.

If the person is conscious: Dentists should place them in a position where they are comfortable and able to breathe easily until the ambulance arrives. If they are feeling faint, they should be laid flat with their legs elevated, if possible.

If the person is unconscious: Dentists should place them in the recovery position (on their side, supported by one leg and one arm, with the head tilted back and the chin lifted). If the person's breathing or heart stops, cardiopulmonary resuscitation should be performed.<sup>[3]</sup>

## Pharmacotherapy

### Adrenaline

Adrenaline (epinephrine) intramuscularly (IM) in the anterolateral aspect of the middle third of the thigh (safe, easy, and effective):

- Adult IM dose 0.5 mg IM (=500 µg = 0.5 mL of 1:1000) adrenaline (epinephrine).

- >12 years: 500 µg IM (0.5 mL) that is, the same as the adult dose.
- 6-12 years: 300 µg IM (0.3 mL).
- <6 years: 150 µg IM (0.15 mL).

If the child is small or prepubertal 300 µg (0.3 mL).

IM adrenaline (epinephrine) should be repeated after 5 min if there is no clinical improvement. Patients requiring repeated IM doses may benefit from IV adrenaline (epinephrine). In these circumstances, expert help is required as soon as possible.<sup>[4]</sup>

Note: IV adrenaline (epinephrine) should only be administered by those having the necessary training and experience such as anesthetists, intensivists and emergency department physicians.

### When adequate skills and equipments are available

Establish airway (in anaphylaxis, airway obstruction from tissue swelling is difficult to overcome and early expert intubation is often needed).

**Intravenous fluid challenge:** Insert one or more large-bore IV cannulae (enable the highest-flow). Use intraosseous access (if trained to do so) in children when IV access is difficult. Give a rapid fluid challenge: Adults - 500 mL of warmed crystalloid solution (e.g., 0.9% saline) in 5-10 min if the patient is normotensive or 1 L if the patient is hypotensive. For children - give 20 mL/kg of warmed crystalloid.

Note: Use smaller volumes (e.g., 250 mL) for adult patients with known cardiac failure and use closer monitoring (listen to the chest for crepitations after each bolus). The use of invasive monitoring, e.g., central venous pressure can help to assess fluid resuscitation.

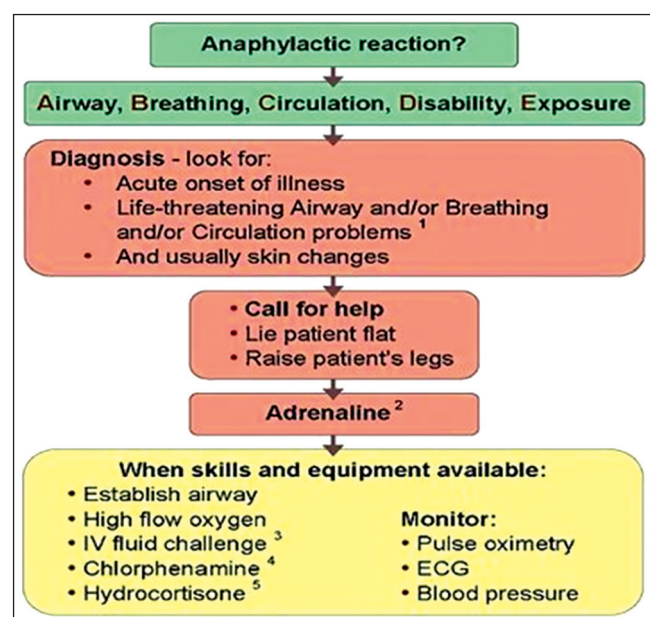
### Beta-agonists

**Isoproterenol** (pure beta-agonist): In patients taking beta-blockers adrenaline would be less effective. Give epinephrine first. If the patient is not responding to epinephrine, use isoproterenol (1 mg in 500 mL). Continuing respiratory deterioration requires further treatment with the bronchodilators, such as salbutamol (inhaled or IV), ipratropium (inhaled), aminophylline (0.25-0.5 g IV).

### Antihistamines

**Chlorphenamine:** (after initial resuscitation). Dose depends on age:

- 12 years and adults: 10 mg IM or IV slowly.
- 6-12 years: 5 mg IM or IV slowly.
- 6 months to 6 years: 2.5 mg IM or IV slowly.
- <6 months: 250 µg/kg IM or IV slowly.



**Figure 1:** Management of anaphylaxis in a nutshell

Diphenhydramine: 50 mg or 1 mg/kg IV slowly repeated if necessary.

Ranitidine: 50 mg IV 8 hourly.<sup>[5]</sup>

### Glucagon

Glucagon: Atropine or glucagon IV if the patient is on beta-blocker failing to respond.

### Corticosteroids

Hydrocortisone: (after initial resuscitation). Dose depends on age:

- >12 years and adults: 200 mg IM or IV slowly.
- >6-12 years: 100 mg IM or IV slowly.
- >6 months to 6 years: 50 mg IM or IV slowly.
- <6 months: 25 mg IM or IV slowly.

### α-agonists

Dopamine: If hypotension persists. 5 µg/kg/min. Increased to 10-20 µg/kg/min.<sup>[6]</sup>

## MONITORING

All critically ill-patients should be given oxygen. Maintain the PaO<sub>2</sub> as close to normal as possible (approximately 13 kPa or 100 mm Hg). When/if a pulse oximeter is available: Titrate the oxygen to maintain oxygen saturation of 94-98%. A normal SpO<sub>2</sub> on oxygen does not necessarily mean ventilation is adequate (because the pulse oximeter detects oxygenation and not hypercapnia). Use bag-mask ventilation while calling urgently for expert help. In an anaphylactic reaction, upper airway obstruction or bronchospasm can make bag-mask ventilation difficult or impossible. Consider early tracheal intubation (if equipment and expertise are available). If the patient is intubated, give high-concentration oxygen with a self-limiting bag. Occasionally, emergency tracheotomy is required. Reassess the pulse rate and BP regularly (every 5 min).<sup>[6]</sup>

### Aim for normal blood pressure

In adults: A systolic BP > 100 mm Hg.

In children: 0-1 month: Minimum 50-60 mm Hg.

>1-12 months: Minimum 70 mm Hg.

>1-10 years 70+ (age in years × 2) mm Hg.

>10 years: Minimum 90 mm Hg.<sup>[7]</sup>

### Further investigation

Serum mast-cell tryptase can be measured in cases of anaphylaxis, particularly to clarify diagnosis where ambiguity exists. Tryptase is the preferred marker for demonstrating mast-cell degranulation (histamine elevation e.g., is very transient). A level of serum tryptase, which is a mast-cell specific protease, is at peak at 1 h

after an anaphylactic reaction, remaining elevated for approximately 6 h. However, not every case of anaphylaxis causes a rise in tryptase - both the sensitivity and specificity are around 95%.<sup>[7]</sup>

Recent guidance from the National Institute for Health and Clinical Excellence advises measurement of mast-cell tryptase as soon as possible after emergency treatment for anaphylaxis. A further sample can be taken after 24 h or at follow-up in an allergy clinic. This establishes an individual's baseline level. In children (under the age of 16), mast-cell tryptase should only be measured in cases thought to be either idiopathic, venom-induced or drug-related.<sup>[8]</sup>

## PROGNOSIS/POSSIBLE COMPLICATION

Without proper treatment anaphylaxis can be deadly. However, most people who receive proper treatment do well. Try to avoid substances that caused the reaction. Drugs classified as beta-blockers, monoamine oxidase inhibitors, angiotensin-converting enzyme inhibitors may make anaphylaxis worse or interfere with treatment. If the patient is having a history of anaphylaxis, check with the physician to find-out if the patient is having one of these medications.<sup>[8]</sup>

## FOLLOW-UP

The patient may need to stay in the hospital for 24 h to make sure no new symptoms occur. For a severe reaction, the doctor may monitor heart function or admit the patient to the intensive care unit. When time allows, take a full history from the patient (relatives, friends, and other staff). This should include documenting all symptoms in full, so as to confirm the diagnosis. In particular, record the time of onset of the reaction and the circumstances immediately before the onset of symptoms. Review the patient's notes and charts. Study both absolute and trends of values relating to vital signs.<sup>[9]</sup> Check that important routine medications are prescribed and being given. Review the results of laboratory or radiological investigations.

### In the long term follow-up

Refer to an allergist or allergy clinic to try to identify the allergen, so that it can be avoided in the future. Organize self-use of preloaded pen injections for future attacks (e.g., EpiPen) containing 0.3 mL of 1 in 1000 strength (that is, 300 µg) for adults and for children 0.3 mL of 1 in 2000 (150 µg).

Give a written self-management plan, information about anaphylaxis and biphasic reactions, and details of the possible signs and symptoms of a severe allergic reaction.

Encourage the patient to wear a MedicAlert bracelet/necklace endorsed by doctor. Observe patients for a period of 6-12 h from the onset of symptoms, depending on their response to emergency treatment. If symptoms are controlled swiftly and easily, a shorter period of observation may be appropriate. Here, it is necessary to ensure a safe discharge to the care of an adult with advice on what to do in the event of further difficulties (i.e., biphasic reaction). Children under 16 with anaphylaxis, should be admitted under the care of a pediatric team, rather than just receiving emergency treatment in the dental clinic.<sup>[10]</sup>

## PREVENTION

If the dental practitioner know what has triggered anaphylaxis, it is important to take steps to try to avoid further exposure to similar triggers.<sup>[11]</sup> If the cause of the allergic reaction is not known, the patient should be referred to a specialist allergy clinic where tests can be carried out to help identify possible triggers. Dentists may be provided with an adrenaline auto-injector to use during any future episodes of anaphylaxis.<sup>[12]</sup>

## CONCLUSION

Some dentists are not aware of this emergency vital clinical condition. Therefore, dentists should develop their knowledge on this subject of the anaphylactic shock management, to prevent this life-threatening event.

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