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MANAGING ANESTHETIC ALLERGIES IN THE DENTAL OFFICE

Iulian ANTONIAC [1], Marian MICULESCU [1], Ovidiu SCHIPOR [2,*]

[1] National University of Science and Technology POLITEHNICA Bucharest, Romania, Faculty of Materials Science and Engineering

[2] "Dunărea de Jos" University of Galaţi, Faculty of Medicine and Pharmacy, Department of Dentistry

Abstract

Allergies to local anesthetics used in dentistry are rare, but they can have serious consequences if not recognized and managed correctly. Differentiating between genuine allergic reactions and non-immunological adverse effects is essential to avoid unjustified restrictions and to apply appropriate treatment. The correct diagnosis involves a detailed anamnesis, allergy testing, and, if necessary, the controlled challenge test. Many reactions are caused by excipients, such as sulfites and parabens, and not by the active substance. Management of patients with suspected allergies includes the use of preservative-free anesthetics, topical anesthesia, inhaled or intravenous sedation, and, in extreme cases, general anesthesia. In emergencies, the dentist must be prepared to intervene promptly, using adrenaline and other support measures. The development of hypoallergenic anesthetics and improved diagnostic techniques will help increase patient safety. A correct approach ensures effective and risk-free treatment for patients with sensitivities to local anesthetics.

Keywords: Allergy, local anesthetics, side effects, patient safety.

Introduction

Allergy to anesthetics used in dentistry is an important concern for both dentists and patients. Although genuine allergic reactions are rare [1-4], many patients report symptoms that can be mistaken for allergies [5,6]. For this reason, a clear differentiation between true hypersensitivity and non-immunological adverse reactions, such as systemic toxicity, anxiety, or vasovagal reactions, is essential [4,7].

Local anesthetics are indispensable substances in dental practice, allowing interventions to be performed without discomfort for the patient [5]. They are divided into two broad categories: esters and amides, the difference between them being essential in the context of allergic reactions [7,8]. Allergy to ester-class anesthetics such as procaine is more common because these substances rapidly metabolize to para-aminobenzoic acid (PABA), a compound known for its allergenic potential [4,7]. On the other hand, anesthetics in the amide class, such as lidocaine, articaine, and bupivacaine, have a much lower risk of causing allergic reactions [1,8,9].

In many cases, the side effects attributed to anesthetics are not allergic manifestations, but are determined by other mechanisms [4,10]. For example, patients may experience tachycardia or palpitations due to the presence of vasoconstrictors (adrenaline, norepinephrine) in the composition of anesthetics [5-7]. These substances have the role of prolonging the effect of anesthesia and reducing bleeding, but they can cause cardiovascular effects experienced by patients as unusual reactions [5]. In other situations, the reported symptoms may be the result of a psychogenic reaction, in which anxiety related to the dental procedure triggers a state of discomfort, nausea, dizziness or even syncope [4,6].

Corresponding author: ovidiu.schipor@usm.ro

Another category of reactions that can be misinterpreted as allergic is the sensitivity to the excipients present in the formulation of anesthetics [7-10]. Preservatives, such as parabens and sulfites, can cause hypersensitivity reactions [1,4], and patients who have a history of allergy to these substances can present various clinical manifestations, from mild rashes to more severe reactions [6]. Sulfites, used to stabilize vasoconstrictors, are involved in some allergic reactions, especially in patients with asthma [2].

In addition, it should be noted that some hypersensitivity reactions to local anesthetics may have a non-immunological mechanism, such as mast cell degranulation without the involvement of IgE antibodies [4,5]. These reactions cause symptoms similar to allergic ones, but do not involve a classic immune response. Therefore, a detailed anamnesis and, if necessary, allergy testing are necessary to confirm or deny the suspicion of genuine allergy [1,4,10].

The importance of correctly recognizing allergies to dental anesthetics is crucial for avoiding complications and for patient safety. A misdiagnosis can lead to the use of suboptimal anesthesia methods or the unnecessary avoidance of safe anesthetics. Also, patients who have a suspicion of allergy should be evaluated by an allergist specialist, so as to determine exactly whether it is a real hypersensitivity or a non-allergic side effect [1,4,10].

Although allergies to local anesthetics are rare, managing them requires a rigorous and well-founded approach [5]. The dentist must be able to differentiate between genuine allergic reactions and other adverse reactions, identify risk factors, and take appropriate measures to prevent and manage complications. In this way, effective and safe treatment is ensured for all patients, including those with a history of allergies or suspicious reactions to dental anesthetics [1,4,5,10].

Causes and mechanisms of allergies to local anesthetics

Allergy to local anesthetics used in dentistry is a relatively rare phenomenon, but it can have significant consequences on patient safety. The mechanism by which these substances can trigger allergic reactions involves both the chemical composition of anesthetics and the presence of excipients that can cause hypersensitivity. Understanding the causes and mechanisms involved is essential for the prevention and proper management of allergic reactions (Figure 1) [1,4,11].

a) after 5 seconds, initial injection site.

b) after 15 minutes, early wheal and flare response.

c) after 20 minutes, peak allergic reaction.

Figure 1. Progression of skin reaction following intradermal testing with a local anesthetic: a) after 5 seconds, initial injection site; b) after 15 minutes, early wheal and flare response; c) after 20 minutes, peak allergic reaction.

Local anesthetics are divided into two main classes: esters and amides. Esters, such as procaines, benzocaines and tetracaines, are more prone to triggering allergic reactions due to their metabolism into para-aminobenzoic acid (PABA), a substance known for its allergenic potential. PABA is responsible for many of the hypersensitivity reactions reported to local anesthetics because it can trigger an IgE antibody-mediated immune response or delayed hypersensitivity reactions. Amides, such as lidocaine, articaine, mepivacaine, and bupivacaine, have a significantly lower risk of inducing allergies because they are not metabolized in PABA [4-7,11,12].

In most cases, the side effects attributed to anesthetics are not actually genuine allergies, but are toxic effects or psychogenic reactions. For example, many patients experience palpitations, tremors, or a feeling of suffocation after taking an anesthetic containing a vasoconstrictor such as adrenaline. These symptoms are often mistaken for allergies, although they are caused by the stimulating effect of adrenaline on the cardiovascular system. Also, anxious patients may develop symptoms similar to an allergic reaction, such as tachycardia, dizziness or shortness of breath, without having a real hypersensitivity to the anesthetic [7,10-13].

In addition to the active substance, local anesthetics contain excipients that may be responsible for allergic reactions. Among the most involved are preservatives, such as methylparabens, and sulfites, which are used to stabilize vasoconstrictors. Parabens can trigger delayed hypersensitivity reactions, while sulfites can worsen symptoms in asthma patients, causing bronchospasm or pseudoallergic reactions. Therefore, patients with a history of allergic reactions should avoid anesthetics containing such additives [11-14].

The immunological mechanisms by which allergy to local anesthetics develops can involve both immediate hypersensitivity reactions (type I) and delayed reactions (type IV). Type I hypersensitivity is mediated by IgE antibodies and causes rapid symptoms, such as urticaria, angioedema, bronchospasm or even anaphylactic shock. These reactions can occur within minutes after the anesthetic is administered and require emergency medical intervention. On the other hand, type IV reactions are mediated by T cells and occur a few hours or days after exposure, manifesting as contact dermatitis, rashes or local inflammation [13-16].

In some cases, patients may experience pseudoallergic reactions, which mimic the symptoms of an allergy, but do not involve an actual immune response. These reactions can be caused by the degranulation of mast cells and the release of histamine in response to certain chemical stimuli, without the involvement of IgE antibodies. For example, some people may experience rashes or itching after taking a local anesthetic, even if allergy tests do not indicate the presence of an actual allergy [4,11-17].

To determine whether a reaction to a local anesthetic is allergic in nature or not, a detailed anamnesis and, if necessary, allergy testing is essential. Skin tests, such as the prick-test or intradermal tests, can help identify a sensitization to the suspected anesthetic. In addition,

determining the level of specific IgE can provide additional information about the mechanism of the reaction. For patients with a history of severe reactions, an allergy consultation is essential to establish an appropriate treatment plan and recommend safe alternatives [1,16-18].

Proper management of patients with suspected allergies to local anesthetics involves avoiding potentially allergenic substances and using alternative formulas without preservatives or sulfites. In some situations, one may opt for the use of an anesthetic from another chemical class or even for the administration of anesthesia techniques without injections, such as hypnosis or inhalation sedation with nitrous oxide. In extreme cases, patients may require interventions under general anesthesia in a controlled environment to reduce the risks associated with an allergic reaction [14-16].

Although allergy to local anesthetics is rare, the mechanisms that can generate side effects are varied and can involve both genuine immunological responses and pseudoallergic reactions or toxic effects. Differentiating them correctly is essential for patient safety and to avoid unnecessary administration of less effective alternative treatments. A good knowledge of the composition of anesthetics, reaction mechanisms, and diagnostic methods allows dentists to properly manage patients at risk of allergies and provide them with safe and effective treatment [11,14,16].

Clinical manifestations of anesthetic allergy

Allergic reactions to local anesthetics used in dentistry can range from mild symptoms, such as itching or rashes, to severe, life-threatening reactions. Clinical manifestations depend on the immune mechanism involved and the individual sensitivity of the patient [4,9,11,12].

The most common allergic symptoms are skin symptoms, which appear shortly after the anesthetic is administered. Patients may experience maculopapular rash, hives, or severe pruritus. These reactions are generally limited and can be treated with antihistamines. In some cases, angioedema may occur, characterized by rapid swelling of the face, lips or eyelids, which can affect respiratory function if the edema extends to the upper airways [4,9,11,12,13,15,16].

Respiratory manifestations are uncommon, but they can be dangerous. Patients with severe hypersensitivity may develop bronchospasm, characterized by shortness of breath, wheezing, and a feeling of suffocation. In extreme cases, laryngeal edema can occur, which causes obstruction of the airways and requires immediate medical intervention. These reactions are typical for type I hypersensitivity, mediated by IgE antibodies, and require prompt administration of adrenaline [4,11,13,15,16,18].

Cardiovascular reactions associated with anesthetic allergies are rare, but they can be severe. Sudden hypotension, tachycardia, and cardiovascular collapse are signs of an anaphylactic reaction. Anaphylactic shock is the most serious form of allergic reaction and can be fatal if not recognized and treated immediately. Initial symptoms include diffuse redness, feeling hot, anxiety, quickly followed by shortness of breath, low blood pressure, and loss of consciousness [4,11,13,15,16,18,19].

In addition to immediate reactions, delayed allergic reactions can also occur, which manifest themselves a few hours or days after the anesthetic is administered. These are usually of the dermatitic type and include rashes, inflammation, and a local burning sensation. Unlike immediate reactions, they are T cell-mediated and do not require emergency intervention, but can be uncomfortable for the patient [4,11,12,16,17].

An important aspect in diagnosing allergic reactions is to rule out other causes of similar symptoms. Many patients confuse the effects of adrenaline in the anesthetic with an allergic reaction, experiencing palpitations, tremors or anxiety after administration. Also, vasovagal reactions, characterized by dizziness and syncope, are often misinterpreted as allergies. The

correct differentiation of these reactions is essential to avoid unjustified restrictions on the use of local anaesthetics [4,6,7,10,13,15].
Anesthetic allergy manifestations can be varied and require prompt recognition to prevent serious complications. The dentist must be able to differentiate genuine allergic reactions from non-immunological side effects, in order to ensure patient safety and to take the necessary measures in case of emergency [4,5,7,11,14,16].

Methods of diagnosis and assessment of allergic risk

Diagnosing allergy to local anesthetics is essential for patient safety and avoiding unjustified restrictions. Since many side effects are mistaken for allergies, a rigorous evaluation is necessary to differentiate between genuine immunological reactions and non-allergic side effects, such as systemic toxicity or psychogenic reactions [11,14,16].

The first step in establishing the diagnosis is the detailed anamnesis. The dentist should investigate the patient's history, asking about the type of anesthetic previously administered, the symptoms that appeared, the time of onset and any treatments applied. It is important to distinguish between a real allergic reaction and symptoms caused by other factors, such as the presence of vasoconstrictors in the anesthetic or anxiety reactions. Patients who have only experienced palpitations or dizziness after an anesthetic injection are usually not allergic, but have had a physiological reaction to adrenaline [13,15].

For patients with a history of suspicious reactions, allergy tests are essential to confirm the diagnosis. Skin testing, including prick-test and intradermal tests, allows the identification of hypersensitivity to local anesthetics. A positive result indicates the presence of sensitization, but should be interpreted with caution as there may be cross-reactivity between different types of anesthetics. In case of a negative result, the risk of a severe allergic reaction to the administration of the anesthetic is minimal [17,18,19].

Another important test is the determination of specific IgE for anesthetics, which can confirm the existence of an immediate hypersensitivity reaction. However, this test is not always conclusive, and in some cases, patients may have non-immunological reactions that are not detected by standard tests. Therefore, in unclear situations, a controlled challenge test can be performed, in which the patient is administered increasing doses of anesthetic under medical supervision to observe possible reactions [14-16,19].

The assessment of the allergic risk must also take into account the sensitivity to excipients in anesthetics. Preservatives such as parabens or sulfites can be responsible for allergic reactions, and patients with a history of allergy to these substances should use anesthetics without additives. To reduce the risks, it is recommended to use alternative anesthetics, such as mepivacaine or prilocaine, which do not contain sulfites [4,7,10].

Once the diagnosis is established, the treatment plan must be adapted to the patient's needs. If the allergy to a local anesthetic is confirmed, an anesthetic from a different class will be chosen, and in extreme cases, alternatives such as intravenous sedation or general anesthesia will be considered [11,14].

Allergy management protocol in the dental office

The management of patients with suspected allergies to local anesthetics is essential for the safety of dental treatment. A well-structured approach includes preventing allergic reactions, quickly recognising symptoms, and applying an appropriate protocol in the event of an adverse reaction [11,14,16].

The first step in prevention is to identify patients at risk of allergies through a detailed anamnesis. The dentist should ask about the history of allergic reactions, the type of anesthetic previously administered, and the associated symptoms. If there is a suspicion of a genuine allergy,

it is recommended to refer the patient to an allergist specialist for testing before any dental intervention. In patients with minor reactions to anaesthetics, the use of sulfite- or paraben-free formulas may reduce the risk of side effects [11,14,16].

If a patient requires local anesthesia and there is an uncertain history of allergy, allergy testing is essential. In situations where the tests are inconclusive, one may opt to administer a test dose in a controlled environment to observe the patient's reactions. If injectable anesthetics pose too high a risk, alternatives such as topical anesthesia, intravenous or inhalation sedation may be considered [16,17,18].

In the event of an allergic reaction in the dental office, the doctor must intervene quickly and efficiently. Mild reactions, such as itching or localized hives, can be managed by taking an oral antihistamine. Moderate reactions, such as angioedema or bronchospasm, require immediate administration of corticosteroids and close monitoring [14-18].

Table 1. Protocol for managing allergies to local anesthetics in the dental office [4,7,10,11,14-18].

Step	*Action*	*Purpose*
1. Risk identification	Detailed medical history and allergy screening	Identify patients with suspected allergy before treatment
2. Specialist referral	Send to allergist for testing if allergy suspected	Confirm diagnosis and determine safe anesthetics
3. Allergen avoidance	Use formulations without sulfites/parabens or alternative methods	Reduce risk of hypersensitivity reactions
4. Test dose	Controlled test administration if allergy history unclear	Observe for adverse reactions in safe conditions
5. Alternative anesthesia	Topical, intravenous sedation, or inhalation anesthesia	Provide pain control when injectables are risky
6. Mild reaction management	Oral antihistamines for pruritus or localized urticaria	Relieve symptoms and prevent progression
7. Moderate reaction management	Immediate corticosteroids, monitor patient	Control angioedema or bronchospasm
8. Severe reaction management	Intramuscular adrenaline (0.3–0.5 mg), oxygen, emergency call	Treat anaphylaxis promptly and prevent fatality
9. Post-reaction evaluation	Allergy specialist review and safe anesthetic planning	Ensure safe future dental treatments

Table 1 summarizes a stepwise protocol for managing local anesthetic allergies in dentistry, from initial risk assessment to emergency intervention. It includes preventive measures, alternative anesthesia options, and appropriate responses for mild, moderate, and severe reactions to ensure patient safety.

In serious situations, such as anaphylactic shock, emergency intervention is crucial. Administration of intramuscular adrenaline, at a dose of 0.3–0.5 mg, should be carried out without delay. The patient must be positioned correctly to maintain blood circulation, and oxygen therapy and ventilator support may be necessary. Simultaneously, the emergency service must be contacted for rapid transport to the hospital. The dentist must be prepared to recognize the signs of anaphylactic shock and have an emergency kit with adrenaline, antihistamines and corticosteroids on hand [16–18].

After managing an allergic reaction, the patient should be evaluated by an allergist to confirm the diagnosis and identify safe anesthetics. In the future, dental treatments should be planned with caution and the anesthetics used should be carefully selected. For patients with

confirmed allergies to multiple substances, general anesthesia may be necessary in complex dental interventions [16–19].

Conclusions

Allergies to local anesthetics are rarer than you think, but they can have important clinical implications. In many cases, the reactions reported by patients are not actual allergies, but side effects or psychogenic reactions. Therefore, a correct assessment is essential to avoid unjustified restrictions and to apply appropriate treatment. Recognizing the mechanisms involved and differentiating genuine allergic reactions from pseudoallergic or delayed hypersensitivity reactions are critical aspects for the management of patients with suspected anesthetic allergy.

A correct diagnosis of anesthetic allergy must be based on a rigorous anamnesis and specific investigations. Many reactions attributed to anesthetics are actually effects caused by excipients, such as sulfites and parabens, or vasovagal reactions due to anxiety. Allergy tests, including the prick-test, intradermal tests, and specific IgE determination, can help identify patients with genuine allergies.

The management of patients with suspected allergies must follow a well-established protocol to avoid risks. If a patient has a history of allergic reactions to an anesthetic, the responsible substance should be accurately identified and the use of anesthetics that may have cross-reactivity should be avoided. It is also recommended to use anesthetics without preservatives, especially those free of sulfites and parabens. In cases where injectable anesthesia cannot be used, alternatives include topical anesthesia, inhaled nitrous oxide sedation, or intravenous sedation. General anesthesia may be necessary in complex situations, but it should only be used when other methods are not viable.

Rapid intervention in the event of an allergic reaction is essential to prevent severe complications. The dentist must be prepared to recognize the signs of an allergic reaction and act promptly. Mild reactions, such as hives or pruritus, can be managed with antihistamines, while moderate reactions, such as bronchospasm or angioedema, require prompt administration of corticosteroids and close monitoring. In the case of anaphylactic shock, the administration of intramuscular adrenaline is essential, along with respiratory support and seeking emergency medical help.

The future of anesthetic allergy management includes developing safer alternatives and improving diagnostic methods. Research in the field of dental anesthesia focuses on creating local anesthetics with a safer profile for patients with allergies, as well as more precise methods of identifying hypersensitivity to certain substances.

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