ALLERGIC REACTION AFTER INJECTING A LOCAL ANESTHETIC DURING DENTAL TREATMENT: A CASE REPORT

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Abstract

A local anesthetic agent which is most commonly used for outpatients is lidocaine hydrochloride that contains epinephrine, which is for vasoconstriction in 1:100,000 concentration. This agent is known as a safe local anesthetic agent and has been used widely for topical use or injections. However, the allergic reaction that we will report in this case occurred when common local anesthesia was done intraorally, and the patient complained of hyperventilation, tachycardia, abdominal pain and unintentional tears. We experienced an allergic reaction after injecting the lidocaine hydrochloride and therefore report the case to suggest that local anesthesia should be always carried out very carefully.

Key words: Allergic reaction, Local anesthetic, Vasoconstriction

Ⅰ. Introduction

The most commonly used anesthetic in outpatient dental care is lidocaine hydrochloride containing the vasoconstrictor epinephrine at a dilution of 1:80,000 to 1:120,000. This agent is generally thought to be safe, and is used in most dental hospitals and clinics without question. Nevertheless, hypersensitivity reactions such as palpitation and dizziness have been rarely reported in association with this local anesthetic.

The side effects of local anesthetics can be classified broadly into toxic and allergic reactions. A toxic reaction may occur when a dose exceeding the maximal allowance is used, when the agent is mistakenly injected into a blood vessel directly, or when metabolic abnormalities caused by liver disease are coincident. However, toxic reactions can be avoided by using the minimal necessary dose, cautious drug administration, and ruling out metabolic abnormality caused by liver disease. In contrast, allergic reactions, although rare, are one of the most common causes of acute harm in relation to dental treatment.[1] The allergic reactions occurring within a few minutes after exposure to an allergen that involve cardiovascular side effects can be identified as anaphylaxis, which is an immunoglobulin E (IgE)-mediated hypersensitivity to foreign substances. In addition, non-IgE-mediated anaphylactoid reactions may occur, which are caused by the direct release of histamine from adipose cells or the activation of the complement system.[2] In other words, the allergen is known an antigen or foreign body that stimulates the release of immunoglobulins into the plasma or other body fluid.[3]

Allergic reactions to local anesthesia are infrequent, but require immediate emergency treatment. The most common presentations of allergic reaction are pruritus or edema and are not fatal; in contrast, a severe hypersensitive reaction leading to anaphylactic shock may threaten the patient's life. Thus, dentists must understand these reactions and be prepared to take action.

In our clinic, we experienced a case of severe allergic reaction after the injection of lidocaine hydrochloride containing epinephrine, which is for vasocon-

striction in 1:100,000 concentration. Here, we report the case together with a review of the literature to show that even this common anesthetic should be administered carefully, and to describe appropriate emergency interventions that can be performed in the dental clinic.

Ⅱ. Case report

A 30-year-old American woman visited the Department of Oral and Maxillofacial Surgery at Chosun University Dental Hospital for extraction of the 3rd molar of mandible. The patient showed periodontal inflammation in the corresponding area due to pericoronitis, and previous occasional flares and edema were reported. The patient informed the clinician that she had unusual medical history, such as tightening of the chest and palpitation, in response to an anesthetic administered during tooth extraction about two years ago. However, she reported that she had experienced no symptoms during several treatments for caries before the tooth extraction, so we couldn't predicate cause. In addition, the patient reported an experience that she routinely developed urticaria and pruritus upon consumption of shrimp, garlic, or grapes. Accordingly, the patient underwent an allergic sensitivity test for lidocaine in the Department of Allergy Internal Medicine at our hospital, and no significant reaction was observed.

The patient then returned to the Department of Oral and Maxillofacial Surgery to undergo tooth extraction. Prior to the procedure, the patient was settled comfortably and monitored oxymetry and blood pressure. As a precaution, specialists from the departments of Anesthesia and Pain Medicine were also present.

Because the patient showed no allergic sensitivity to lidocaine, anesthesia was initiated using lidocaine with 1:100,000 epinephrine. Inferior alveolar nerve block anesthesia was performed, and in consideration of previous potential allergic reactions, only one-half of an ampule (about 0.9 ml) was injected in approximately 30 seconds. However, immediately after injection, the patient demonstrated difficulty in swallowing, itchiness. In addition, she complained abdominal pain and discharged teardrops. Flares on the skin were also observed, although edema was not detected. The patient then complained of palpitation.

Although 0.5 cc epinephrine (dilution of 1:1,000) had been prepared in anticipation of an emergency situation, the patient recovered immediately (although the skin flares remained) and thus epinephrine (dilution of 1:1,000) was not injected intramuscularly. Instead, the patient was administered 100% oxygen through a mask and allowed to rest. Subsequently, American women was given an intramuscular injection of antihistamine and corticosteroid and recovered immediately. As part of our follow-up procedure, we requested the patient to follow up to the hospital for additional sensitivity testing for lidocaine (scratch and intradermal tests in the skin and oral cavity), but the patient refused to call.

Ⅲ. Discussion

The anaphylaxis is 1 in 3,000 hospitalized patients, and approximately 500 patients die every year.[4] And the hypersensitivity by anesthetics is 1 in 3,500-20,000 persons, with a fatality rate of 3-6%.[5] The allergic reaction is less than 1% of all adverse reactions caused by local anesthetic agents,[6] showing the rarity of true allergic reaction. The allergic reaction should be differentiated from adverse reactions but, distinguishing between these two mechanisms can be difficult. In addition, the accidental intravenous administration or overdose of local anesthetics may cause toxic side effects, such as dizziness, myospasm, diplopia, bradycardia, reduction of cardiac output, and seizure.[7] In the absence of positive immunological tests that can definitively rule out IgE-mediated hypersensitivity, the differentiation between toxic and allergic mechanisms is more difficult. Due to this difficulty in differentiating between a true allergic reaction and other adverse reactions, dentists are strongly recommended to perform allergic tests prior to anesthetics injection and review emergency interventions in case of an undetected sensitivity.

Generally, local anesthetics are classified broadly into two types according to the type of aromatic bond (amide or ester). Ester-linked anesthetics undergo hydrolysis to form the antigenic substance para-aminobenzoic acid (PABA), and thus allergic reac-

tions are more frequent.[8] In contrast, lidocaine with an amide bond features less allergic reactions. Allergic reactions can be classified into four types according to the rapidity of the antigen-antibody reaction: types 1, 2, and 3 are immediate-type reactions, and the type 4 reaction is a delayed reaction.[9] The IgE-mediated type 1 reaction is referred to as anaphylaxis and may result in death if emergency treatment is not properly administered. The type 1 reaction and the T-cell-mediated type 4 reaction are the most frequently elicited reactions in response to local anesthetics, and both of these reactions are most commonly induced by ester chemicals.[10,11] However, Mackley *et al.*[12] have reported rare cases in which type 4 hypersensitivity developed in response to lidocaine; the authors mentioned that if positive results are obtained from a patch test for lidocaine, an intradermal test should be performed.

In addition to the anesthetic itself, allergic reactions may occur in response to other substances used in the preparation or administration of local anesthetics. Preservatives in anesthetics, for example, may induce type 1 and type 4 hypersensitivity.[10,13,14] The most widely used preservatives are methylparaben and propylparaben; because these molecules are structurally similar to PABA, their presence is more often associated with allergic reactions.[10] Furthermore, Campbell *et al*[15] reported the development of allergic reactions in response to the antioxidant metabisulfite, the authors also mentioned the possibility need to perform sensitivity testing for other additives within drug cartridges. Hikaru *et al*[16] reported two cases of allergic reaction in response to epinephrine. In these cases, skin testing using diluted epinephrine was performed, and positive results were observed. Accordingly, the drug lymphocyte stimulation test (DLST) was carried out using components of exogenous epinephrine hydrochloride, epinephrine bitartrate, chlorbutanol, and sodium hydrogensulfate, and both patients showed positive reactions in response to each component. Thus, exogenous epinephrine may also induce allergic reactions.

Careful pre-procedural evaluation is necessary to prevent a drug-induced allergic reaction or anaphylaxis during dental treatment. Detailed information on previously experienced symptoms and the specific drugs administered should be collected. In the event of a previous allergic reaction or suspicious symptom, allergic sensitivity tests should be performed prior to surgery (e.g., the patch test, scratch test, or intradermal test). Patch tests should be carried out according to the standards of the International Contact Dermatitis research Group.[17] Scratch tests, also known as prick tests, are frequently used because they are minimally invasive and highly reproducible.[9] In general, solutions at 1:100 dilution or undiluted drugs are used; however, if a serious reaction to the undiluted solution is anticipated, dilutions of 1:1,000 or 1:10,000 may be attempted.[11,18] Intradermal tests are applied to observe both immediate and delayed immune reactions.[19,20] Mackley *et al.*[12] used the lidocaine patch test on 183 patients and discovered four patients showing positive reactions. Hodgson *et al.*[21] demonstrated that patients with a past history of allergic reaction to local anesthesia showed a much higher incidence of allergic reaction (24.6%) in response to the intradermal lidocaine test than control patients.

In addition to pre-procedural testings, the ability to manage a developing emergency condition in response to true hypersensitivity or some other mechanism is critical. Regarding anaphylactic shock, the time until emergency treatment is key, and thus general dentists should be well prepared regarding emergency management methods.

Allergic reaction is one of most common conditions among the rare instances of dental emergency. 2,583 cases were non-life-threatening allergic reactions and 304 cases were anaphylaxis in 30,602 emergency situations.[22] Anaphylaxis is characterized by a series of events; In the first stage, pruritus, edema, or flares are observed on the skin. In the second stage, teardrops or other secretions are discharged from the exocrine gland. In the third stage, respiratory symptoms (e.g., broncheal spasm) develop, followed by cardiovascular symptoms (e.g., hypotension).

The administration of epinephrine is critical to survival.[1] Intramuscular injections of epinephrine (diluted to 1:1,000) every 5 minutes, while simultaneously correcting the patient's posture to open the airway and performing cardiopulmonary resuscitation with a continuous supply of oxygen at 5-6 L per minute.[1] If

Table 1. Dosage of medications for treatment of anaphylaxis

Drug	Dose / route
Epinephrine	1:1,000 0.1 mg/kg IM (max, 0.5 mL) 1:10,000 0.01 mg/kg IV over 1-2 minutes Continuous infusion: 0.1 μg/kg/minute
Diphenhydramine (H_1 blocker)	1-1.25 mg/kg (max, 50 mg) PO/IM/IV
Ranitidine (H_2 blockers)	1 mg/kg IV (max, 50 mg)
Cimetidine	4 mg/kg IV (max, 300 mg) given slowly
Hydrocortisone (corticosteroids)	1-2 mg/kg IV

hypotension due to anaphylaxis is occurred, should be treated by placing the patient in the Trendelenburg position. The antihistamines are useful adjunctive treatment in the recovery phase and effective in relieving pruritus and urticaria.[23] And corticosteroids is to prevent recurrence of symptoms or protracted anaphylaxis. The drugs and doses for treatment of anaphylaxis are presented in Table 1.[24]

The sudden development of hypotension, tachycardia, dyspnea, or dermal lesions during local anesthesia may signal an allergic reaction to local anesthetic. However, lack of emergency preparedness in this situation (i.e., lack of pre-procedural testing and failure to review emergency management methods) may lead to unfortunate results. Lidocaine, in particular, is widely used and is only rarely associated with anaphylaxis; however, because lidocaine-induced anaphylaxis is potentially life-threatening, dentists should always bear this possibility in mind. In addition, allergic reactions may also develop in response to preservatives, antioxidants, or other substances contained within the drug cartridge. We think that allergic reaction is occurred by another substances within lidocaine cartridge in this case. Thus, patients with previous suspected allergic episodes should be referred for sensitivity testing for local anesthetics and other potential allergens. In addition, review of emergency interventions and emergency management should be performed. Indeed, dental practice may greatly benefit from the establishment of routine allergic sensitivity testing for local anesthetics and clinical guidelines for the prevention and treatment of emergency situations in a clinical setting.

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원고 접수일 2010년 01월 18일
게재 확정일 2010년 03월 22일

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Paper received 18 January 2010
Paper accepted 22 March 2010