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Case Report Open Access

Successful Finding of Local Anesthetics for a Girl with Local Lidocaine Anaphylaxis

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Abstract

A 16-year-old-girl with a past medical history of lidocaine anaphylaxis requested an allergy test to find a local anesthetic (LA) agent with no adverse allergic reactions for her ingrown toenail treatment. A skin prick test (SPT) and intradermal test were administered using lidocaine, procaine, bupivacaine, mepivacaine and ropivacaine. All LA agents used in the SPT showed negative result. An intradermal test was then administered and lidocaine, procaine, bupivacaine, and mepivacaine showed positive results while ropivacaine showed negative results. Based on these results, a subcutaneous challenge with ropivicaine was performed showing no local or systemic symptoms. The next day the girl was discharged and her ingrown toenail was successfully treated with ropivicaine with no adverse reactions or symptoms.

All physicians should be aware of the risk of local anesthetics and consider the possibility of cross-reactivities within both the ester and amide group to prevent any adverse allergic reactions.

Keywords: Lidocaine; Anaphylaxis; Skin tests; Cross reactions

Introduction

Local anesthetic agents are commonly used in clinical medicine as they allow various procedures to be performed safely and comfortably. Actual allergic reactions to local anesthetics (LAs) are very rare upon comparison to muscle relaxant or latex allergies, representing at the most less than 1% of all adverse LA reactions [1]. LAs are prevalent subtypes of ester and amide and are available as topical preparations and injectable agents. Allergic reactions have mainly been described with ester type LAs. Lidocaine is an antiarrhythmic and a local anesthetic agent of the amide type, and it is a safe and effective local anesthetic commonly used for various aspects of medicine including bronchoscopy, endoscopy, and minor surgical procedures. Although the probability of having allergic hypersensitivity due to amides of lidocaine hydrochloride is low, anecdotal hypersensitivity reactions on account of lidocaine have been reported [2].

This case report presents a case of finding non-anaphylactic local anesthetic agents based on a thorough screening and successful treatment with no adverse reactions.

Case Report

A 16-year-old-girl with no current health problems arrived at the hospital and requested an allergy test to find a local anesthetic agent with no adverse allergic reactions. Previous to arrival, she had been refused surgical procedure by a dermatologist for an ingrown toenail because of her past medical history of anaphylactic shock after injection of lidocaine for an extraction of a wisdom tooth 4 years ago. Symptoms included pruritus of lips and tongue, breathing difficulty, chest tightness, vomiting, blurry vision, followed by loss of consciousness ten minutes after injection. After this event, no further procedures requiring local anesthetic agent were administered. Her past medical history showed an atopic dermatitis resulting in mild eczema on her thigh at age 6. There was no allergic reaction history with injection other then lidocaine before. Also, there was no other allergic disease and no family history of allergy.

Upon admittance to the hospital for finding a non-anaphylactic local anesthetic agent, her vital signs were stable and appeared to be healthy with no urticaria, or facial edema. Physical examination showed no physical abnormalities. Complete blood cell count showed WBC 6.5×10^3, RBC 4.5×10^6, neutrophil 63% and eosinophil 0.9%.Total IgE was 31.8 IU/ml and chemistry test was within normal range.

With her parent's signed permission, a skin prick test (SPT) and intradermal test were administered using lidocaine, procaine, bupivacaine, mepivacaine and ropivacaine, all of which contained no preservatives. Throughout the SPT session, vital signs were closely monitored.

SPT results were read after 15 minutes. A wheal larger than that of the positive control was considered as a positive result. Positive controls produced a 4×4 mm wheal with histamine. The saline negative control did not produce any wheals. Allergic symptoms, such as wheals or redness, were not produced with LA agents used in the SPT test (Figure 1).

An intradermal test with normal saline dilutions of 1:10 and 1:5 ratios were then administered. The 1:10 dilution of lidocaine, procaine, bupivacaine, and mepivacaine, resulted in wheals of 4×7 mm, 5×7 mm, 3×4 mm, and 8×7 mm, respectively. Ropivacaine showed negative results (Figure 2a). As the intradermal test with 1:10 dilution of bupivicaine only showed weakly positive result, a 1:5 dilution of bupivicaine was added to the 1:5 dilution of ropivacaine test which resulted in a 6×7 mm wheal and negative results, respectively (Table 1 and Figure 2b).

Based on these results we expect ropivacaine to have the lowest chance of allergic reaction. To ensure these results a subcutaneous challenge with ropivicaine was performed showing no local or systemic symptoms after 30 mins and 24 hrs. Vital signs and oxygen saturation remained normal throughout the test. The next day the patient was

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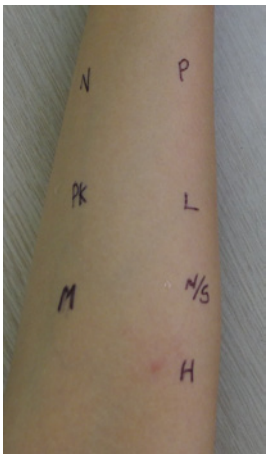

Figure 1: Skin prick test with histamin and other anesthetics. H: Histamine; L: Lidocaine; P: Procaine; M: Mepivacaine; PK: bupivacaine; N: ropivacaine.

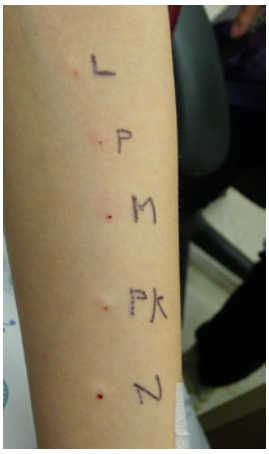

Figure 2a: Intradermal test with anesthetics (dilution of 1:10 ratio). L: Lidocaine; P: Procaine; M: Mepivacaine; PK: bupivacaine; N: ropivacaine.

discharged from the hospital with no symptoms and went back to the dermatologist where her ingrown toenail was successfully treated with ropivicaine with no adverse reactions or symptoms.

Discussion

Anaphylaxis is a severe systemic reaction caused by mediators released from immune system cells due to immediate IgE-mediated hypersensitivity reaction. It can produce allergic reaction with respiratory and/or cardiovascular involvement. Other organ systems often involved such as skin (itch, rash, flushing, angioedema) and the GI tract (vomiting, diarrhea, tummy pain). With estimated mortality rates from 3% to 6%, the prevalence of anaphylactic reaction to anesthetics ranges between 1:3500 and 1:20,000. Less than 1% of the adverse reactions caused by local anesthetics are attributed to true allergy [3]. There are two types of allergic reactions to LAs, IgE-mediated type 1 reactions and T-cell mediated type 4 reactions. Type 1 and type 4 reactions may be hard to separate clinically because no clear temporal separation has been determined [4]. The assessment of side effects developing during local anesthesia should also include some other factors, which are sometimes confused with the hypersensitivity

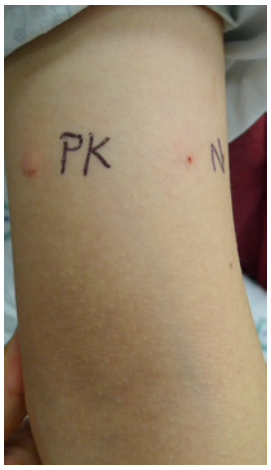

Figure 2b: Intradermal test with anesthetics (dilution of 1:5 ratio). PK: bupivacaine; N: ropivacaine.

	Skin prick test	Intradermal test	
	Wheal	Wheal (1:10 dilution)	Wheal (1:5 dilution)
Control			
Histamine	4×4 mm	4×4 mm	
Saline	Negative		
Esters			
Procaine	Negative	5×7 mm	
Amides			
Lidocaine	Negative	4×7 mm	
Mepivacaine	Negative	8×7 mm	
Bupivacaine	Negative	3×4 mm	6×7 mm
Ropivacaine	Negative	Negative	Negative

Table 1: Wheal size of skin prick test and intradermal test for local anesthetics.

Ester	Amides
Benzocaine	Articaine
Chloroprocaine	Bupivacaine
Cocaine (methylbenzoylecgoine)	Dibucaine (cinchocaine)
Procaine (novocaine)	Etidocaine
Proparacaine (alcaine)	Levobupivacaine
Tetracaine (amethocaine)	Lidocaine (lignocaine)
	Mepivacaine
	Prilocaine
	Ropivacine
	Sameridine
	Tonicaine

Table 2: Ester and amides local anesthics.

reaction (toxic actions, effects of simultaneous administration of adrenaline, vasovagal syncope, anxiety reactions or hyperventilation syndrome) [5]. In this case of anaphylaxis, changes developed over 10 minutes and involved three body systems (affecting mucosal, respiration and circulation).

The purpose of skin testing should be to find one single LA the patient can dependably rely on in future medical procedures. If a strong anaphylactic reaction is suspected, a drug from a different class of LAs should be used. However, due to the exceptionality of anaphylactic reactions in patients with local anesthesia, the causative drug can generally be used [6]. The best method of skin testing for this purpose remains controversial. Intradermal testing has been used first

in the majority of studies; however, three studies have demonstrated that prick testing has a similar efficacy [7]. In a prospective comparison of prick and intradermal testing in the same patients, Leynadier et al. [8] suggested that prick testing was the better test. Some authors argue that both prick testing and intradermal test should be removed from the test protocol because their specificities are low [9]. In this case, it is doubtful if a skin prick test is a better test than an intradermal test since positive intradermal tests have been carried out despite of negative results from previous skin prick tests for some LA agents.

Drug provocation tests should be performed following negative skin testing if there is a clear benefit for the patient. Subcutaneous challenge should not be performed in patients with conditions such as severe asthma or underlying cardiac disease and in patients who have experienced life-threatening immunocytotoxic reactions [10].

Local anesthetics were divided into two groups (Table 2): (i) amide derivatives of xylidine and toluidine group (lidocaine, prilocaine, mepivacaine, lignocaine) and (ii) ester or benzoic and aminobenzoic derivatives (benzocaine, cocaine, butacaine, procaine, tetracaine) [11]. Cross-reactivities are common within both the amide and ester group but cannot be predicted from the structure of the ionisable amide group [12].

Local anesthesia is also associated with hypersensitivity to the preservatives in them–sulphites, parabens, nickel, and latex or antiseptic agents [6]. The most widely used preservatives are methylparaben and propylparaben and in this case, all preservatives that could create a false positive were eliminated to ensure the integrity of the test. For anxiety reaction, many patients experience sweating, dizziness, nausea and light tachycardia before minor surgery. Nearly 22% of patients visiting a travel health clinic were afraid of injections, and among 8.2%, the fear was unreasonably intense [13].

Toxic reactions include convulsions, hypotension, bradycardia and eventually cardiovascular collapse, coma and even death may also be observed if a high dose of LA is used or in case of accidental intravascular injection [12]. Thus, by staying within safe dosage parameters and using safe injection techniques, the risk of toxic reactions may be minimized.

In this case, the diagnosis of safe LA agents for our patient was made base on skin testing. Physicians should be aware of the possibility of cross-reactivities within both the ester and amide groups and use the least amount of LA agent to prevent any adverse allergic reaction.

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