

Knowledge of Dentistry Students on Local Anesthetic Systemic Toxicity and Intravenous Lipid Rescue Therapy: A Cross-Sectional Questionnaire-Based Study

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ABSTRACT

Objective: This study aimed to evaluate the level of knowledge of dentistry students on local anesthetic systemic toxicity (LAST), which will provide important information that will help in scheduling the educational content of the future syllabus before graduation, in order to prepare the students for possible challenges in the future.

Methods: This study included 234 dentistry students who were in the 3rd, 4th, and 5th years of education, at 2018–2019 educational year of Gaziantep University, Faculty of Dentistry. It was conducted in a cross-sectional questionnaire-based manner. The revised questionnaire form included questions regarding the frequency of encountered LAST cases, signs of LAST they had observed, and treatments for LAST that they had used, particularly lipid treatment.

Results: The questionnaire was sent to 234 dentistry students who were in the 3rd, 4th, and 5th degree in the Gaziantep University Faculty of Dentistry and 215 of them responded to the study (91,88%). The majority of the participants (93%, n = 200) declared that they had received training about LAs. Among the participants, 38,60% (n = 83) of them preferred only one LA agent, whereas the remaining participants preferred multiple agents. In addition, most of the participants 79,5% (n = 171) declared that they had not observed LAST, while only 15 of the students stated that they have encountered LAST (7%) and had used an alternative therapy rather than the intravenous lipid rescue therapy. None of the students personally administered the lipid rescue therapy.

Conclusion: The results of this current study demonstrate the evident need for additional educational effort to create awareness regarding LA use and the effective management of LAST among dentistry students.

Keywords: Local anesthetics, dentistry, toxicity, local anesthetic systemic toxicity, lipid emulsion

INTRODUCTION

Local anesthetics (LAs) are frequently used in routine clinical practice and may sometimes be associated with systemic toxicity. Studies in the literature regarding the awareness of local anesthetic systemic toxicity (LAST) among different medical specialties are lacking due to the misdiagnosis or underreporting of similar events (1-3).

Therefore, we conducted a cross-sectional questionnaire-based study to assess the level of knowledge on LA use and the effective management of LAST among dentistry students in Gaziantep University Faculty of Dentistry. This study will provide important information that will help in scheduling the educational content of the future syllabus before graduation, in order to prepare the students for possible challenges in the future.

METHODS

This study included 234 dentistry students who were in the 3rd, 4th, and 5th degree at 2018–2019 educational year, second semes-

ter of Gaziantep University Faculty of Dentistry, after obtaining approval from the ethical committee (2019/318). Oral informed consent was obtained and the participants filled a questionnaire form. The study was conducted in a cross-sectional questionnaire-based manner, which was adapted from a previous study by Öksüz et al. (4). Students are supposed to have one semester of a lecture entitled 'Local anesthesia in dentistry' in the third year and one semester of another lecture entitled 'General anesthesia in dentistry', including a lecture on LAs, in the fourth year in Gaziantep University Faculty of Dentistry. All 4th and 5th degree students use local anesthesia during their clinical practice on behalf of their preceptors during various rotations

The revised questionnaire form includes questions regarding the frequency of LAST cases encountered, signs of LAST they had seen, and treatments for LAST, particularly lipid treatment, they had used. The questionnaire contains multiple-choice questions that are shown at Figure 1.

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Figure 1. Study Questionnaire (revised from Öksüz et al [4])**Thank you for participating our questionnaire about local anesthetic systemic toxicity (LAST) and treatment.**

1. Age:
2. Degree of class:
3. Did you have training about local anesthesia (LA)?
Yes () No() Don't remember ()
4. Choose the local anesthetics that you most frequently use.
Articaine () Bupivacaine () Lidocaine () Prilocaine () Mepivacaine ()
Articaine with vasoconstrictor () Lidocaine with vasoconstrictor () Prilocaine with vasoconstrictor ()
Mepivacaine with vasoconstrictor ()

Evaluation of degree of knowledge about local anesthetics.

5. LA dose: No idea () Not sure () Know well() Know Very Well ()
6. LA contraindications: No idea () Not sure () Know well() Know Very Well ()
7. LA complications: No idea () Not sure () Know well() Know Very Well ()
8. LA maximum dose: No idea () Not sure () Know well() Know Very Well ()
9. LA side effects: No idea () Not sure () Know well() Know Very Well ()
10. Treatment of LA side effects: No idea () Not sure () Know well() Know Very Well ()
11. Recognize signs and symptoms:
Tachycardia () Syncope () Irritability () Tinnitus () Metallic taste in the mouth () Allergic reactions () Hypotension ()
Hypertension () Stupor () Convulsion ()
12. Have you ever seen LAST?
Yes () No () Unaware () Don't remember ()
13. Do you know intravenous lipid treatment in LAST?
Had no idea about intravenous lipid rescue therapy ()
Had heard but did not have enough knowledge about it ()
Had read an article about lipid rescue therapy ()
Know how to use lipid rescue therapy ()
14. Have you ever use intravenous lipid treatment in LAST?
Had never seen local anesthetic toxicity ()
Had seen it but used treatments other than lipid rescue therapy ()
Had seen it and used intravenous lipid therapy ()

Main Points:

- Studies in the literature concerning awareness of local anesthetic systemic toxicity (LAST) among different medical specialties is lacking due to misdiagnosis or underreporting of similar events.
- The level of consciousness of LAST among dentistry student that will provide helpful information for scheduling the educational content of the future syllabus before graduation to prepare the students for possible challenges in the future.
- There is evident need for additional educational effort to create awareness regarding LA use and effective management of LAST among dentistry students.

Statistical Analysis

Statistical analysis was performed with the Statistical Package for Social Sciences for Windows version 11.5* (SPSS Inc.; Chicago, IL, USA) and the results are shown in tables and presented as descriptive statistics.

RESULTS

The questionnaire was sent to 234 dentistry students who were in the 3rd, 4th, and 5th degree in Gaziantep University Faculty of Dentistry and 215 of them responded to the study (91,88%). Mean age of the participants was 22,52±1,41 years (Min. 20 – max. 27). Most of the participants (93%, n=200) declared that they had received training about LAs. The most preferred LAs are shown in Table 1.

Among the participants, 38,60% (n=83) of them preferred only one LA agent, whereas the remaining participants preferred multiple agents. The degrees of knowledge of the participants regarding the LAs they had used are shown in Table 2.

In addition, most of the participants 79,5% (n = 171) declared that they had not observe any LAST before, but only 15 of the students stated that they had encountered LAST (7%), although they used an alternative therapy rather than the intravenous lipid rescue therapy. None of the students personally administered the lipid rescue therapy.

We showed that 42,8% (n = 92) of the participants had knowledge about lipid rescue therapy in LAST, although they could not remember the management of this clinical situation. Twelve of the students (5,6%) declared that they knew how to administer the lipid rescue therapy with intravenous lipids. Approximately 10,7% (n = 23) participants had read articles about the therapy, whereas 40,9% (n = 88) of the participants had received no information concerning this therapy.

Most of the common LA adverse effects observed in clinical practice are shown in Table 3.

DISCUSSION

The side effects frequently observed with the use of LA are often minor and/or transient. The symptoms of the side effects are on a

broad spectrum, ranging from mild symptoms to life threatening severe ones, such as cardiac arrest and involvement of the central nervous system.

Individual patient risk factors, concurrent medications, location, and technique of the block, specific LA compound, total LA dose, timing of detection, and adequacy of treatment are risk factors that determine the severity of LAST. History of LAST articles in the literature goes back to 1884, with the introduction of cocaine to clinical practice in 1884, bupivacaine in the 1970s, and ropivacaine and levobupivacaine in the late 1980s (5, 6). Research studies are aimed at clarifying the pathophysiology of LAST and novel treatment modalities like lipid emulsion. The first guideline regarding the role of lipid emulsion to manage LAST was published by the Association of Anesthetists of Great Britain and Ireland in 2007 (7). The American Society of Regional Anesthesia and Pain Medicine (ASRA) reported practice guidelines regarding the prevention and treatment of LAST in 2010 (8). According to these guidelines, the treatment of refractory LAST requires conventional therapies (airway management with 100% O₂, convulsion therapy, cardiopulmonary resuscitation if cardiac arrest occurs), including lipid emulsions 20% intravenous lipid solutions at the dose of 1,5 mg/kg intravenously followed by 15 ml/kg/h infusion for maintenance. In case of persistent symptoms, a bolus dose can be administered twice without exceeding the limit of 10 ml/kg.

LAST rarely occurs in dentistry. However, they can become a serious problem if the clinical symptoms and signs are underestimated and appropriate steps are not taken. Unfortunately, to our best of knowledge, epidemiologic studies regarding the frequency of LAST in dentistry are not available (9).

The performance of inferior alveolar nerve blockade is relatively common in dentistry (15.3%). Therefore, the expected risk of LAST may be higher while performing the aforementioned nerve block.

The frequency of use of ester-type local anesthetic agents is low. Among amide-type LAs, lidocaine is the most commonly used local anesthetic agent, which has a low potency (10).

According to our results, the most commonly used local anesthetic was lidocaine (74.41%). Bupivacaine is a long-acting local anesthetic agent, which has a severe cardiotoxic potential. Car-

Table 1. Most commonly preferred local anesthetic agents among participants

Agent Preferred	Number of Participants	Percentage (%)
Lidocaine	160	74,41
Lidocaine + vasoconstrictor	4	1,86
Articaine + vasoconstrictor	2	0,93
Articaine	88	40,93
Bupivacaine	18	8,37
Prilocaine	9	4,18
Mepivacaine	7	3,25

Table 2. The degree of knowledge of the participants regarding the LAs used

	Know very well % (n)	Know well % (n)	Not sure % (n)	No idea % (n)
LA doses	10,7 (23)	33,5 (72)	46 (99)	9,8 (21)
LA contraindications	8,4 (18)	23,3 (50)	56,3 (121)	12,1 (26)
LA complications	8,4 (18)	25,1 (54)	52,6 (113)	14 (30)
LA maximum doses	4,2 (9)	34,9 (75)	45,6 (98)	15,3 (33)
Adverse effects of LA	8,4 (18)	21,4 (46)	56,7 (122)	13,5 (29)
Management of adverse events	11,2 (24)	40 (86)	37,7 (81)	11,2 (24)

Table 3. Most common LA adverse effects observed in clinical practice

Signs and symptoms	Percentage (%)	Number
Tachycardia–palpitation	52,09	112
Syncope	27,44	59
Irritability	24,18	52
Tinnitus	5,58	12
Metallic taste in the mouth	6,04	13
Allergic reactions	25,11	54
Hypotension	21,86	47
Hypertension	9,30	20
Stupor	4,18	9
Convulsion	0,93	2
None	0,93	2

diac arrest cases due to bupivacaine-induced LAST are known to be resuscitation-resistant cases (11). Among the amide-type LAs, percentage of choice of bupivacaine was relatively low (8.37%). We need to remember that our study population consisted of dentistry students. The more they become experienced, the more they will treat complicated cases that may need long-acting nerve blockade with bupivacaine.

Even if the practitioner's choice is an amide-type local anesthetic, the risk of LAST is still present. Furthermore, if a patient is allergic to this drug, ester-type LAs, which have high potency, have to be chosen (9).

Unfortunately, most of the clinics that administer LAs do not readily have anesthesiologists in charge at their clinic. All non-anesthesiologist practitioners including dentists have to be conscious of LAST symptoms and signs and also the therapeutic modalities. In a study by Öksüz et al. (4), of 600 dentists, 404 (67.3%) of the respondents declared that they had no idea about lipid treatment, 128 (21.3%) had heard about lipid treatment but said they did not have enough knowledge of it, 59 (9.8%) had read an article about lipid treatment, but only 9 (1.5%) knew how to administer the lipid treatment. Another study among 124 dentists demonstrated that they were aware of some side effects of LAs with vasoconstrictors; however, they had inadequate knowledge about the signs and symptoms of LAs overdose (12).

Published case reports regarding LAST (13-15) in the literature most commonly depend on the experience of non-anesthesiologists. Interestingly, a Danish survey study among anesthesiologists in 2011 concluded that there was limited knowledge of lipid rescue therapy in LAST (3). It can be speculated that the guidelines about lipid emulsion therapy were relatively new at the time period of the study. A study performed at a similar time period among dermatologists found similar results. According to

this study, the awareness of intravenous lipid rescue therapy was lower than expected (22%) (2).

Nurses who work in preoperative and postoperative care units, outpatient services, labor and delivery units, and even operation room circulating nurses usually do not receive formal education or training about the diagnosis and treatment of LAST events (16).

Ophthalmologists are another group of specialists who frequently use LAs. A questionnaire study performed among 104 ophthalmologists reported that 76% of the participants declared that they use LAs every day or more than twice a week; however, 56.7% of them had no specific training about this clinical situation (17).

CONCLUSION

Dentistry practitioners who perform various nerve blocks multiple times a day also have to be aware of LAST. A dentist who encounters a LAST case should accurately know about its rapid recognition. In addition, treatment with lipid emulsion therapy has to be kept in mind. We have to incorporate education on LA safety and the treatment of LAST in mandatory training sessions. The introduction of national guidelines on lipid rescue therapy would probably accelerate this process.

In this context, academic trainers have a very important mission to prepare their students. The content of the local anesthesia lectures have to be reviewed and arranged regarding these concerns. The results of this current study demonstrate the evident need for additional educational efforts to create awareness regarding LA use and the effective management of LAST among dentistry students.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Gaziantep University Clinical Investigations Ethical Committee (2019/318).

Informed Consent: Oral informed consent was obtained from patients who participated in this study.

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