

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

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## ABSTRACT

**Objective:** The aim of this study was to evaluate the level of consciousness of local anesthetic systemic toxicity (LAST) among dentistry students, which would provide helpful information for scheduling the educational content of future syllabus before graduation to prepare students for possible challenges in the future.

**Methods:** This study included 234 dentistry students, who were in the 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> degrees during the period 01 December 2018–01 April 2019, and was conducted using a cross-sectional questionnaire-based design. The revised questionnaire form includes questions addressing the frequency of encountered LAST cases, signs of LAST they had seen, and treatments for LAST, particularly lipid treatment, they had used.

**Results:** The questionnaire was sent to 234 dentistry students in the 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> degrees at the Faculty of Dentistry, Gaziantep University, Gaziantep, Turkey, of whom 215 (91.8%) responded. The majority of participants (93%, n=200) declared that they received training about local anesthetics (LAs). Only one LA agent was preferred among 38.60% (n=83) of participants, whereas other participants preferred multiple agents. A significant majority of the participants (79.5%; n=171) declared that they did not observe LAST before this study, whereas only 15 (7%) students mentioned that they had encountered LAST but used an alternative therapy rather than intravenous lipid rescue therapy. None of the students personally applied lipid rescue therapy.

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

**Keywords:** Dentistry, lipid emulsion, local anesthetic systemic toxicity, local anesthetics, toxicity

## INTRODUCTION

Local anesthetics (LAs) are frequently used in routine clinical practice and sometimes may be associated with systemic toxicity. However, there is a lack of studies in the literature concerning the awareness of local anesthetic systemic toxicity (LAST) among different medical specialties due to misdiagnosis or underreporting of similar events (1-3).

Therefore, we conducted a cross-sectional questionnaire-based study to determine the level of knowledge about LA use and the effective management of LAST among dentistry students at the Faculty of Dentistry, Gaziantep University. Our aim was to evaluate the level of consciousness of LAST among dentistry students, which would provide helpful information for scheduling the educational content of future syllabus before graduation to prepare students for possible challenges in the future.

## METHODS

After obtaining approval from Gaziantep University Clinical Researches Ethical Committee (2019/318), a total of 234 dentistry students, who were in the 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> degrees during the period 2018–2019, were included in this study. Verbal informed consent was obtained from these participants before they filled in their questionnaire form. This study was conducted in a cross-sectional, questionnaire-based manner, which was adapted from a previous study conducted by Oksuz et al. (4). Students are supposed to have one semester of a lesson entitled “Local anesthesia in dentistry” in the 3<sup>rd</sup> year and one semester in “General anesthesia in dentistry,” including LA lessons in the 4<sup>th</sup> degree at the Faculty of Dentistry, Gaziantep University. All the 4<sup>th</sup> and 5<sup>th</sup> degree students use local anesthesia during their clinical practice on behalf of their preceptors in various divisions.

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The revised questionnaire form includes questions addressing the frequency of encountered LAST cases, 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 Appendix 1.

**Statistical Analysis**

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

**RESULTS**

The questionnaire was sent to 234 dentistry students, who were in the 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> degrees at the Faculty of Dentistry, Gaziantep University, of whom 215 (91.88%) responded. Mean age of the participants was 22.52±1.41 years (range 20–27 years). The majority of them (93%, n=200) declared that they received training about LAs. Most of them preferred LAs as shown in Table 1.

Only one LA agent was preferred among 38.60% (n=83) of the participants, whereas others preferred multiple agents. The degrees of knowledge of the participants about the LAs they used are presented in Table 2.

**Table 1.** Most commonly preferred LA agents among participants

Agent preferred	Number of participants	(%)
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

LA: local anesthetic

A significant majority of the participants (79.5%; n=171) stated that they did not observe LAST before this study, whereas only 15 (7%) students mentioned that they had encountered LAST but used an alternative therapy rather than intravenous lipid rescue therapy. None of the students personally applied lipid rescue therapy.

We also observed that 42.8% (n=92) of the participants had heard about lipid rescue therapy for LAST, but they did not remember how to manage this clinical situation. Among the study participants, 12 (5.6%) mentioned that they knew how to use lipid rescue therapy with intravenous lipids. A total of 23 (10.7%) participants had read articles about the therapy, whereas 88 (40.9%) participants stated that they did not hear anything about this therapy. Table 3 shows the most common LA-related adverse effects observed in clinical practice.

**DISCUSSION**

The side effects frequently observed in the use of LAs are often minor and/or transient. The symptoms of side effects fall on a broad spectrum, ranging from mild to life-threatening severe ones, including cardiac arrest, to the involvement of the central nervous system.

Individual patient risk factors, concurrent medications, location and technique of block, specific LA compound, total LA dose, timing of detection, and adequacy of treatment are the risk factors that entail the severity of LAST. The history of articles on LAST published in the literature goes back to 1884, with the introduction of cocaine to clinical practice in 1884, bupivacaine in 1970s, and ropivacaine and levobupivacaine in late 1980s (5, 6). Research studies are aimed at lightening up the pathophysiology of LAST and on novel treatment modalities such as lipid emulsion. The first guideline regarding the role of lipid emulsion in the management of LAST was published by the Association of Anaesthetists 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). These guidelines state that the treatment for refractory LAST can be performed using conventional therapies (airway management with 100% O<sub>2</sub>, convulsion therapy, and cardiopulmonary resuscitation if cardiac arrest occurs) and lipid emulsions using 20% intravenous

**Table 2.** The degree of knowledge of the participants regarding LAs they use

	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)

LA: local anesthetic

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

Signs and symptoms	(%)	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

LA: local anesthetic

lipid solutions with a 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 applied twice more without exceeding a limit of 10 mL/kg.

The occurrence of LAST cases in dentistry is rare. However, they can become a serious issue if the clinical symptoms and signs are underestimated and appropriate steps are not taken. Unfortunately, to the best of our knowledge, there are no epidemiologic studies regarding the frequency of LAST in dentistry (1).

Inferior alveolar nerve blockade is relatively commonly performed in dentistry (15.3%); therefore, the expected risk of LAST may be higher while performing this nerve blockade procedure. The frequency of the use of ester-type LA agents is not high. Among amide-type LAs, lidocaine is the most commonly used LA agent, which has low potency (10).

According to our results, the most commonly used LA agent was lidocaine (74.41%). Bupivacaine is a long-acting LA agent with a severe cardiotoxic potential. Cardiac arrest cases caused due to bupivacaine-induced LAST are known as resuscitation-resistant cases (11). Among the amide-type LAs, the percentage of choice of bupivacaine was relatively low (8.37%). One has to consider that our study population consisted of dentistry students. The more they become experienced, the more they can treat complicated cases that may require long-acting nerve blockade with bupivacaine.

Even when the practitioner's choice is amide-type LAs, the risk of LAST is still present. Furthermore, if a patient is allergic to this drug, one has to choose the ester-type LAs that have high potency (9).

Unfortunately, most of the clinics that apply LAs do not readily have anesthesiologists in charge at their clinic. All nonanes-

thesiologist practitioners, including dentists, have to be alert of LAST symptoms and signs and hence the therapy modalities. In a study conducted by Oksuz et al. (4) among 600 dentists, 404 (67.3%) respondents mentioned that they had no idea about lipid treatment, 128 (21.3%) had heard about lipid treatment but said that they did not have sufficient knowledge about it, and 59 (9.8%) had read an article about lipid treatment, but only 9 (1.5%) knew how to use lipid treatment. Another study conducted among 124 dentists demonstrated that the subjects were aware of some side effects about LAs with vasoconstrictors; however, they had inadequate knowledge about the signs and symptoms of overdose of LAs (12).

Published case reports regarding LAST (13-15) in the literature most commonly depend on the experience of nonanesthesiologists. Interestingly, a Danish survey study conducted among anesthesiologists in 2001 concluded that the study subjects had limited knowledge about lipid rescue therapy for LAST (3). It can be speculated that the guidelines about lipid emulsion therapy were relatively new at the study time period. A study performed at a similar time period among dermatologists reported similar results, wherein the awareness of intravenous lipid rescue therapy was lower than expected (22%) (2).

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

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

Dentistry practitioners who perform various nerve block procedures multiple times a day also have to be aware of LAST. A dentist who confronts a LAST case should accurately understand about rapid recognition and also consider about treatment with lipid emulsion therapy. Therefore, we have to incorporate education on LA safety as a treatment for LAST in mandatory training sessions. In addition, introduction of national guidelines on lipid rescue therapy would probably accelerate this process.

## CONCLUSION

In this context, academic trainers have a very important mission to prepare their students to encounter possible challenges in the future. The content of local anesthesia lessons has to be reviewed and arranged in view of these concerns. The results of this study implicate the evident need for additional educational effort to create awareness about LA use and effective management of LAST among dentistry students.

You can reach the questionnaire of this article at <https://doi.org/10.5152/EurJTher.2020.19094>.

**Ethics Committee Approval:** Ethics committee approval was received for this study from Gaziantep University Clinical Researches Ethical Committee with approval number: (2019/318).

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

**Peer-review:** Externally peer-reviewed.

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## REFERENCES

- Sagir A, Goyal R. An assessment of the awareness of local anesthetic systemic toxicity among multi-specialty postgraduate residents. *J Anesth* 2015; 29: 299-302. [CrossRef]
- Walsh AM, Moran B, Walsh SA. Knowledge of local anesthetic use among dermatologists. *Dermatol Surg* 2012; 38: 882-7. [CrossRef]
- Jensen-Gadegaard P, Skjønnemand M, Damgaard-Jensen J, Gottschau B. Limited knowledge of lipid rescue therapy in local anesthetic systemic toxicity. *Dan Med Bull* 2011; 58: A4226.
- Oksuz G, Urfalioglu A, Sekmen T, Akkececi N, Alpay N, Bilal B. Dentists knowledge of lipid treatment of local anaesthetic systemic toxicity. *Niger J Clin Pract* 2018; 21: 327-31.
- Albright GA. Cardiac arrest following regional anesthesia with etidocaine or bupivacaine. *Anesthesiology* 1979; 51: 285-7. [CrossRef]
- Di Gregorio G, Neal JM, Rosenquist RW, Weinberg GL. Clinical presentation of local anesthetic systemic toxicity: a review of published cases, 1979 to 2009. *Reg Anesth Pain Med* 2010; 35: 181-7. [CrossRef]
- Association of Anaesthetists of Great Britain and Ireland. Intralipid in the management of LA toxicity: guidance from the Association of Anaesthetists of Great Britain and Ireland (AAGBI), 2007. <http://www.aagbi.org/publications/guidelines/docs/latoxicity07.pdf> (accessed 26 Aug 2009).
- Neal JM, Bernardis CM, Butterworth JF 4th, Di Gregorio G, Drasner K, Hejtmanek MR, et al. ASRA practice advisory on local anesthetic systemic toxicity. *Reg Anesth Pain Med* 2010; 35: 152-61. [CrossRef]
- Rhee SH, Park SH, Ryoo SH, Karm MH. Lipid emulsion therapy of local anesthetic systemic toxicity due to dental anesthesia. *J Dent Anesth Pain Med* 2019; 19: 181-9. [CrossRef]
- Taghavi Zenouz A, Ebrahimi H, Mahdipour M, Pourshahidi S, Amiri P, Vatankhah M. The incidence of intravascular needle entrance during inferior alveolar nerve block injection. *J Dent Res Dent Clin Dent Prospects* 2008; 2: 38-41.
- El-Boghdadly K, Pawa A, Ghalib H. Local anesthetic systemic toxicity: current perspectives. *Local Reg Anesth* 2018; 11: 35-44. [CrossRef]
- Pinheiro AC, Marques J, Pereira MS, Branco-De-Almeida LS. Dentists' knowledge regarding signs and symptoms of the systemic toxicity of local anesthetic solution. *Rev Gaúch Odontol* 2015; 41-6. [CrossRef]
- Donald MJ. Dermatitis from lignocaine toxicity; a complication of local anaesthesia administered in the community. *Emerg Med J* 2004; 21: 249-50. [CrossRef]
- Dornic E, Kuntz AF, Kelsey J, Holstege CP. Lidocaine-induced altered mental status and seizure after hematoma block. *J Emerg Med* 2006; 31: 251-3. [CrossRef]
- Marra DE, Hip D, Fincher EF, Moy RL. Systemic toxicity from topically applied lidocaine in conjunction with fractional photothermolysis. *Arch Dermatol* 2006; 142: 1024-6. [CrossRef]
- Marguson W, Coogle C, Leppert J, Odom-Maryon T. Local anesthetic systemic toxicity (LAST): designing an educational effort for nurses that will last. *J Perianesth Nurs* 2019; 34: 180-7. [CrossRef]
- Urfalioglu A, Urfalioglu S, Oksuz G. The knowledge of eye physicians on local anesthetic toxicity and intravenous lipid treatment: questionnaire study. *Turk J Ophthalmol* 2017; 47: 320-5. [CrossRef]

Withdrawing

**Appendix 1. Study Questionnaire (revised from Oksuz et al.)**

Thank you for participating in 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 used 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 ( )