Diş Hekimlerinin Lokal Anestezikler, Toksisitesi ve Lipid Tedavisi Hakkındaki Bilgi Düzeyleri: Anket Çalışması

Dentists' Knowledge of Local Anesthetics, Local Anesthetic Toxicity and Lipid Therapy: A Survey Study

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Atıf/Citation: Karasu, D., Özgünay, Ş. E., Yılmaz, C. & Uğuz, İ. (2019). Diş Hekimlerinin Lokal Anestezikler, Toksisitesi ve Lipid Tedavisi Hakkındaki Bilgi Düzeyleri: Anket Çalışması. Ege Üniversitesi Diş Hekimliği Fakültesi Dergisi, 40(2), 69-75.

ÖZ

Amaç: Lokal anestezikler diş hekimleri tarafından yaygın olarak kullanılmaktadır. Bu çalışmanın amacı; diş hekimlerinin lokal anestezikler, lokal anestezik toksisitesi ve lipid tedavisi hakkındaki bilgilerini incelemek ve bu konu hakkındaki farkındalığı artırmaktır.

Yöntem: Bursa ilinde çalışmakta olan diş hekimleri çalışmaya dahil edildi. Katılımcılara lokal anestezikler, lokal anestezik toksisitesi ve lipid tedavisi hakkındaki anket formu verildi.

Bulgular: Çalışmamız için 600 katılımcı hedeflendi fakat katılımcıların %17'si anketi tamamladı. Katılımcıların yaş ortalaması 40.71 ve çalışma yılı 16.91 idi. %52.9'u kadın ve %55.9'u Sağlık Bakanlığına bağlı kurumlarda çalışmaktaydı. Katılımcıların %19.6'sı lokal anestezik toksisitesi görmüş, %59.4'ü lipid tedavisini hiç duymamıştı, %2.1'i lipid tedavisini biliyordu.

Sonuç: Toksisitesinin ölümcül olabilmesi açısından diş hekimleri lokal anestezikler, lokal anestezik toksisitesi ve tedavisi hakkında yeterli bilgiye sahip olmalıdırlar. Her kurumda lokal anesteziklerin sistemik toksisite tedavisinde lipid tedavisinin yönetimine ilişkin talimatlar hazırlanmalıdır ve çabuk ulaşılır bir yerde bulunmalıdır.

Anahtar kelimeler: Lokal anestezik, toksisite, intravenöz lipid emülsiyonu, diş hekimi, anket

ABSTRACT

Objectives: Local anesthetics are commonly used by dentists. The aim of this survey study is to investigate dentists' knowledge of local anesthetics, local anesthetic toxicity, and lipid emulsion therapy, and to raise awareness on this issue.

Methods: The study was carried out with dentists working in Bursa province of Turkey. The participants were asked to fill out a survey form addressing local anesthetics, local anesthetic toxicity, and lipid therapy.

Results: Although the targeted participant number was 600, only 17% of the participants completed the survey. The average age of the participants was 40.71 years with the average working experience of 16.91 years. Of all participating dentists, 52.9% was women and 55.9% was working at institutions affiliated to the Ministry of Health. According to the survey results, 19.6% had encountered with the cases of local anesthetic toxicity; 59.4% had never heard of lipid emulsion therapy whereas 2.1% knew with lipid emulsion therapy.

Conclusion: Considering the fact that toxicity can be fatal, dentists should have adequate information about local anesthetics, local anesthetic toxicity, and the treatment of toxicity. Instructions regarding the management of lipid emulsion treatment should be prepared in every institution for the treatment of local anesthetic-induced systemic toxicity and kept in a readily accessible place.

Key words: *Local anesthetic, toxicity, intravenous lipid emulsions, dentists, survey*

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Başvuru Tarihi/Received Date: 14.02.2018
Kabul Tarihi/Accepted Date: 10.01.2019

INTRODUCTION

Local anesthesia is the loss of sensation in a certain area of the body caused by the blockage of conduction in peripheral nerves or by the reduction of the nerve impulses.1 Qualities of the anesthetic agent used for local anesthesia, such as protein binding, lipid solubility, pH, the stability constant (pKa) level, and the vascularity of the injection site are the key factors that affect both anesthesia and systemic toxicity.2 Toxic side effects of local anesthetics are related to either their local pharmacological effects or their uptake into the systemic circulation. Clinicians should be on alert for liver and kidney failure and take the recommended maximum dose and drug interactions into consideration. The iatrogenic overdose of a local anesthetic can lead to local anesthetic toxicity. The principal organ systems influenced by the toxicity of local anesthetics are the central nervous system (CNS) and cardiovascular system (CVS). The CNS is more sensitive to the effects of local anesthetics than the CVS. CNS symptoms such as dizziness and tinnitus appear earlier as compared to the symptoms in the cardiac system.3 The initial indications of CVS toxicity are manifested with sympathetic nervous system activation, which may later progress to arrhythmia or deep cardiovascular collapse due to increased plasma concentration of local anesthetic.4

Local anesthetics have an important place in dentists' daily practice. For this reason, dentists must have the potential complications of these agents at their fingertips. They must be aware of the chair position, needle phobia, the risk for liver or kidney failure, the recommended maximum dose, and drug interactions.5 The use of the recommended doses and protocols of local anesthetics, detailed history taking, pre-injection aspiration, and slow injection may help prevent the local anesthesia-related complications including allergic reactions.6,7 Also, the use of lipid emulsion treatment should be well known by dentists.

In this study, we aim to investigate dentists' knowledge of local anesthetics, local anesthetic toxicity, and lipid emulsion therapy, and to raise awareness in this regard.

MATERIALS and METHODS

Population characteristics

Following the approval of the local ethics committee (2011-KAEK-25 2016/17-10) and the obtainment of the informed consents, the dentists, who were working in Bursa province of Turkey and willing for participation, were enrolled in the study. A survey form was prepared to measure knowledge on local anesthetics, local anesthetic toxicity, and lipid therapy. The form was delivered to the dentists working at the Ministry of Health (MoH) affiliated institutions. In order to reach a higher number of dentists, particularly those that work and own private practices, the survey form was made available on the internet. The participants, who left more than 50% of the survey questions blank, were excluded from the study.

Statistical analysis

For 10% margin of error and for 95% confidence levels 83 dentists were required. Data was analyzed by using SPSS 21 Windows (Statistical Package for the Social Sciences, Armonk, NY, USA) package program. While numeric variables were expressed in mean ± standard deviation, categorical variables were expressed in numbers and percentages. A p value < 0.05 was considered as statistically significant.

RESULTS

Our study target was a total of 600 participants. However, 38 participants were excluded from the study as they completed less than 50% of the survey. Ultimately, a total of 102 (17%) participants' surveys could be involved in the statistical analysis. Table 1 shows the demographic data of the participants. The average age of the participants was 40.71 years. Of all participants, 52.9% was women and 55.9% was working at institutions affiliated to the MoH (Table 1). The survey questions regarding local anesthetics and local anesthetic toxicity are shown in Table 2.

When participants were divided into two groups by the workplace as dentists working at the MoH hospitals

Table 1: Demographical characteristics (SD: standard deviation)

Variables	mean±SD, (%)
Age (years)	40.71 ± 9.82
Gender	
• Male	(47.1)
•Female	(52.9)
Institution	
•Ministry of Health	(55.9)
•Private	(44.1)
Year of working	16.91±9.50

Table 2: Questions about local anesthetics and toxicities

Questions	**%**
Which local anesthetics do you prefer?	
• Articaine	46.9
• Articaine+ epinephrine	27.6
• Lidocaine+ epinephrine	16.3
• Mepivacaine	5.1
• Lidocaine	3.1
• Prilocaine	1
Have you ever been trained in local anesthetics after the university?	
• Yes	65.7
• No	30.4
• I do not remember	3.9
Have you experienced local anesthetic toxicity?	
• Yes	19.6
• No	73.5
• I am not aware	3.9
• I do not remember	3
What do you do in the treatment of local anesthetic toxicity?	
• Calling 112	5.9
• Antihistamine production	3.9
• Oxygen therapy	2.9
• Trendelenburg position	2.9
• Cardiopulmonary resuscitation	2
• Adrenaline production	1
• Unanswered	81.4
Have you heard of lipid emulsion therapy?	
• I've never	59.4
• I do not remember	38.5
• I know well	2.1
Are there instructions for local anesthetic toxicant treatment in your institution?	
• Yes	20.7
• No	73.9
• I do not know	5.4
Would you like to learn about these topics?	
• Yes	100
What is your choice to be informed?	
• Seminar	48.1
• Congress	20.6
• Internet	17.7
• Articles	5.9
• Other	0

and dentists working at private institutions, the majority of the dentists employed in private practice were found to be men whereas the majority of the dentists employed at state hospitals were women. Additionally, the percentage of the dentists receiving training on local anesthetics and lipid emulsion therapy were significantly higher at state institutions as compared to private institutions (Table 3).

DISCUSSION

Dentists commonly make use of local anesthetics. The participation rate to this survey study was 17%. According to the survey results, 55.9% of the participants were employed at the MoH affiliated institutions and 65.7% received training on local anesthetics. Also, 19.6% had encountered with local anesthetic toxicity cases, and 2.1% was acquainted with lipid emulsion therapy. Although the percentage of the dentists receiving training on local anesthetics was significantly higher at the MoH institutions, their knowledge on lipid emulsion therapy was limited.

The systemic effects of local anesthetic agents occur following the absorption and subsequent increase of blood level of the agents. Local anesthetic toxicity may result from several factors including the dose, method, and rate of administration. Administering the same dose of an agent at a slow ratio can reduce toxicity.2,8 Various factors including the type, concentration, dose, and administration technique of the agent, patient's age, acid-base balance, potassium level, liver blood flow and hepatic diseases, renal diseases, pregnancy, nutrition, and drug interactions may influence toxicity.9

One of the most feared complications associated with the use of local anesthetic agents is allergy and anaphylaxis. Baluga et al.10 reported 0.5% allergic reactions due to local anesthetics during dental interventions. Allergic reactions mostly take the form of skin rash or urticaria. The rapid onset of these lesions indicates that the incident can progress rapidly and turn into a systemic reaction. Anaphylaxis, which is a serious allergic reaction, starts with skin rash and spreads to the eyes and nose ultimately affecting the respiratory system and cardiovascular system.11

Sambrook et al.12 investigated a total of 227 suspected adverse reactions that had been associated with dental local anesthetic agents used in Australia and excluded 6 of them (prolonged anesthesia, facial paralysis) from the investigation. The reactions were syncope 27%, CNS 16%, CVS 9%, allergy 34%, methemoglobinemia 3% and other 20%. There were 3 cases of death (1%) reported in that study, and the local anesthetics associated with mortality for these three cases were prilocaine, lidocaine, and prilocaine plus adrenalin. In the same study, medical records of the last 35 years were examined and sixteen cases of anaphylaxis were discovered. Prilocaine was found to be the local anesthetic with the highest adverse effect (70%). In the present study, the usage rate of prilocaine was indicated to be 1%. Lidocaine is frequently used in dentistry but has

Table 3: Comparison of data according to institutions (MoH: Ministry of Health, SD: standard deviation)

	MoH (n=57) (mean ± SD, %)	**Private (n=45)** (mean ± SD, %)	**p**
Age (years)	39.36 ± 9.23	42.17 ± 10.32	0.167
Year of working	15.59 ± 9.02	18.57± 9.93	0.116
Sex			
• Male	35.1	62.2	0.006*
• Female	64.9	37.8	
Participants trained after university	82.5	44.4	<0.001*
Participants who experienced local anesthetic toxicity	21.4	17.8	0.636
Participants who know lipid emulsion treatment	0	4.8	0.267
Participants with instructions	28.3	10.3	0.091

*p<0.05statistically significant. Ki-kare

been indicated to cause systemic toxicity.13 In our study, the usage rate of lidocaine was reported to be 19.4%. Although articaine, a local anesthetic introduced for the use in dental practice, has an excellent safety profile, it may cause systemic intoxication if accidentally injected intravascularly.14 The rate of intravenous injection for the inferior alveolar nerve block, which can occur due to the high vascularization of the oral mucosa, has been reported to be 15.3%.15 Articaine has been reported to cause allergic reactions.12 In this study, articaine had the highest utilization rate (74.5%).

There are examples of systemic complications in the literature related to the use of local anesthetics by doctors other than anesthesiologists.16,17 Chiu et al.18 reported that a four-year-old child developed anaphylaxis fifteen minutes after the administration of local lidocaine for a dental procedure.

The accidental overdose of local anesthetics may be fatal. Although local anesthetics are the most frequently applied agents in dental practice, local anesthetic systemic toxicity (LAST) is rarely encountered.19 The clinical presentation of LAST is varied and includes numerous signs and symptoms related to the CNS (i.e. tinnitus, dizziness, seizures, coma) and the CVS (i.e. bradycardia, hypotension, arrhythmia) which can lead to cardiac arrest and death.20 LAST courses with local anesthetic-induced cardiac arrest, and due to being particularly resistant to standard resuscitation methods, it has led to a high mortality rate at dentists' offices.15 Within the scope of toxicity therapy, the aim is to ensure airway management and to treat the potential symptoms such as convulsion and cardiac arrhythmia. In recent years, 20% lipid therapy has gained an important place in the treatment of local anesthetic toxicity. The American Society of Regional Anesthesia and Pain Medicine (ASRA) recommended 20% lipid emulsion therapy in its guidelines published in 2012 on LAST treatment.21 We think that although ASRA guidelines are easily accessible, it has low recognition among our participants. Ciechanowicz et al.19 stated in the review published in 2012 that dentists did not have enough awareness on the use of intravenous lipid emulsion therapy for the treatment of LAST. In this study, the percentage of the dentists familiar with lipid emulsion therapy was 0% among those working at the MoH affiliated institutions while it was 4.8% among those working at private institutions. Collins et al.22 carried out a study on the awareness of hospital staff members on local anesthetic toxicity and reported that the percentage of hospital staff members, other than the anesthesiologists, accurately informed of lipid emulsion therapy was 7% and of initial dosage was 3%. A study that we conducted among the research assistants at our hospital indicated that 67.4% of the participants had never heard of lipid emulsion therapy.23 The aforementioned studies and the results of the present study highlight the importance of training for physicians, who regularly use local anesthetics without the presence of an anesthesiologist.

If symptoms and signs of LAST including dizziness, agitation, tachycardia, and hypertension are detected, the airway should be maintained to avoid hypoxia and acidosis. Because hypoxia and acidosis can lead to poor prognosis. Seizures should be treated with a benzodiazepine.24,25 In the case of LAST, 20% lipid emulsion administration is effective in treating cardiovascular collapse and CNS symptoms. It is recommended to start 20% lipid emulsion at a dose of 1.5 mL/kg after airway management. It should be infused at a rate of 0.25 mL/kg/min. In the absence of cardiac instability, the same dose can be repeated after 10 min; however, the total dose administered within 30 min should not exceed 10 mL/kg.21 Especially at private clinics and at the institutions, where anesthesiologists are not employed, there must be instructions on the management of lipid therapy to be kept at easily accessible places. According to our results, there were such instructions available at 20.7% of the institutions, where our participants worked. Also, the majority of these institutions were affiliated to the MoH.

The reactions associated with local anesthetic agents can be evaded through careful selection and accurate dosage of the local anesthetic agents.14 In order to minimize toxicity, medical history taking must be carefully performed and higher attention must be given to the patients with a tendency to develop an allergy. If a patient has an allergy to a local anesthetic agent, a drug from a different drug group should be tried. If an agent is going to be tried for the first time, a test must be performed beforehand. Considering potential early or late reactions, required equipment must be kept available at the clinic. Moreover, dental assistants must be also informed about allergic reactions.26

Oksuz et al.27 investigated the knowledge of 600 dentists in Turkey about symptoms of LAST and quantify how often they have used lipid emulsion. The results of their study showed that 42.8% of respondents had training about local anesthesia, but 46% had no training about local anesthesia and 11.1% could not remember having been trained about local anesthesia. In the present study, training about local anesthetic after the university, no training and no remembering of training were 65.7%, 30.4% and 3.9% of respondents, respectively. Their results also demonstrated that 86.66% of participants had never seen LAST. In our study, 73.5% of respondents hadn't seen LAST. In their study, 67.3% had no idea about lipid treatment, only 1.5% knew how to use lipid treatment. In our study 59.4% of respondents had never heard about lipid therapy, 2.1%

knew well.

Conducting the study in one single province and the small number of participants that completed the survey (17%) were the limitations of this study.

CONCLUSION

Dentists perform millions of local anesthetic injections with a few side effects per day. Local anesthetics can cause various adverse effects ranging from mild dizziness to cardiac arrest. LAST, which is relatively fatal, can occur even if the practitioner is highly experienced. Dentists, who regularly use local anesthetics in daily practice, must be able to identify the patients with an increased risk of toxicity and be familiar with preventive precautions, early symptoms of toxicity and the management of toxicity at the initial phase through intravenous lipid emulsion therapy. Also, the instructions on the use of local anesthetics should be easily accessible. To be sufficiently knowledgeable about local anesthetic-related reactions and to keep the instructions available at the workplace shall be lifesaving in the treatment of potential LAST complications.

Acknowledgements

We would like to extend our thanks to Bursa Chamber of Dentists for their contributions to the completion of the survey.

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