

Information on local anesthetics and toxicity for doctors in surgical department of Karadeniz Technical University Medical Faculty Hospital

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Abstract

Aim: Local anesthetics are commonly used in surgical interventions and anesthesia applications. The aim of this study was to increase the sensitivity of local anesthetic toxicity to the presence of symptoms, precautions to be taken and the use of 20% lipid infusion for treatment.

Material and Methods: The questionnaire was applied on 160 of 205 physicians who were prescribed local anesthetics.

Results: Of the 160 participants included in the study, 108 (67.5%) were research assistants, 47 (29.4%) were faculty members and the remaining 5 (3.1%) were expert medical practitioners. 63 of the participants (39.4%) had been working in the medical profession for more than 5 years. While 42.5% of the participants administered local anesthetics every day, 33.1% had not received any training in the area. On the basis of their training status, it was the anesthetists among specialist doctors who were the most trained in anesthetics with a statistically high rate of 86.3%.

Thirty-three of the surveyed physicians (20.6%) who responded stated that they had experienced a case of local anesthetic toxicity previously. The most frequent answer to the question in early findings concerning local anesthetic toxicity was anaphylaxis (74.4%). 38.1% of the participants had not heard the use of 20% lipid solution in local anesthetic toxicity. Although there was 20% lipid solution in the university hospital where the research was conducted, 31.9% of the participants knew this.

Conclusion: Although local anesthetic toxicity is rare, it frequently occurs in clinical practice. Therefore, physicians should have general knowledge regarding local anesthetic drugs, maximum doses, side effects, toxicity symptoms and the required treatment in the case of toxicity. We also think local anesthetic toxicity should be included in annual training programs and practical applications by other clinical branches that apply local anesthetic drugs as we currently do at our Clinic and physicians should be given appropriate guidance.

Keywords: Intralipid; local anesthetic; toxicity; questionnaire

INTRODUCTION

Local anesthetics are frequently used not only by anesthesiologists but also by the physicians from other surgical branches, especially in the surgical interventions and anesthesia applications on small areas.

Local anesthetics block the transmission of Na⁺ ions into the cell when they contact the nerve fibers at the appropriate concentration and block the conduction and generation of depolarization waves through the cell reversibly. They affect not only the nerve fiber membrane but also all excitable cell membranes dose-dependently (1). Although local anesthetic drugs are generally safe, they may be toxic if used at high doses or administered

incorrectly. The effects of local anesthetic agents depend on many factors such as fat solubility, binding to a protein, pH, vascularity of the injected area and solubility equilibrium (pKa) (2).

Even if the dosage and route of administration of local anesthetics are appropriate, patients may experience undesirable reactions of local anesthetics. In 99% of the systemic reactions to local anesthetic agents, the cause is the high blood levels of the drug. The first systems affected by local anesthetic toxicity are the central nervous system (CNS) and the cardiovascular system (CVS). Accordingly, patients usually complain of metallic taste in the mouth, tinnitus, visual impairment, drowsiness, tremors and dizziness. In the following stages, convulsions and

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cardiac arrhythmias (bradycardia or tachycardia) may occur. Apnea, coma, cardiac arrest, and death may occur in the late stage (3).

Early intervention is very important in the treatment of the toxicity. First of all, drug injection should be discontinued and immediate airway control should be ensured. Symptomatic treatment should be initiated considering the affected system; especially convulsions should be controlled and cardiovascular support should be provided. In addition to the conventional resuscitation practices in the cardiac toxicity of local anesthetics, intravenous lipid solution (ILVS) is used as an effective and new treatment option (4).

Intravenous lipid solution treatment was first introduced in the guidelines published by the British and Irish Anesthesia Society in the year of 2007 to prevent local anesthetic toxicity (5). In 2010, the American Society of Regional Anesthesia and Pain Medicine (ASRA) developed the local anesthetic systemic toxicity (LAST) and included the IVLS treatment (6).

In our study, having asked questions to the physicians of the surgical department, we were informed of the possibility of local anesthetic toxicity, the symptoms that need to be considered to recognize toxicity, and precautions that should be taken to prevent inadvertent excessive or wrong infusion, and we aimed to raise awareness about the use of IVLS for treatment when potential LAST is experienced.

MATERIAL and METHODS

160 out of 215 physicians working at the surgical departments of the Karadeniz Technical University Medical Faculty Hospital were included in this single-centered study upon the approval of the Karadeniz Technical University Medical Faculty Ethics Committee (2017/650). The inclusion criteria were history of local

anesthetic use at least five times and being a surgical physician. Fifty-five participants who did not want to fill in the questionnaire were excluded from the study. Among those not included in the study, 15 were anesthetists, 8 were orthopedists, 7 were gynecologists, 6 were general surgery, 6 were brain surgery, 6 were eye surgery, 4 were ear-nose-throat surgery and 3 were urology. The knowledge level of the participants, whose awareness on the importance and treatment of local anesthetics and toxicity will be evaluated, was examined in four parts.

In the first part of the survey, the participants were asked about their ages, branches, experience and academic careers.

In the second part of the survey, general information about local anesthetics, frequency of use, routes they prefer to use, and whether they administered a test dose were asked (Table 1).

In the third part of the survey, they were asked about whether they had experienced local anesthetics toxicity, their experience in early and late toxicity findings and whether they took precautions to avoid toxicity.

In the fourth part of the survey, they were asked about their experience in the treatment of local anesthetic toxicity, experience in 20% lipid use and whether they had shortcomings on this subject and whether they would like to receive training.

The data obtained from the study was analyzed with the version 23.0 of the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL) software licensed by the Karadeniz Technical University Medical Faculty. The chi-square test was used to compare the qualitative data. The mean, standard deviation, and percentage distributions were used as descriptive statistics.

Table 1. Mark the following questions about the pharmacological properties of local anesthetics as true or false

| | Questions | True | False |
|----|--|------|-------|
| 1 | Local anesthetics are divided into two groups as amide and ester structured | | |
| 2 | Sodium channels are the main target for the effectiveness of local anesthetics | | |
| 3 | Large myelin-free fibers are less sensitive than small myelin-free fibers | | |
| 4 | Lidocaine is an ester | | |
| 5 | Procaine is an ester | | |
| 6 | The addition of epinephrine improves the quality of analgesia, prolongs the duration of action | | |
| 7 | The maximum dose of lidocaine is 3 mg / kg | | |
| 8 | Bupivacaine can be administered intravenously | | |
| 9 | Prilocaine is a long-acting local anesthetic | | |
| 10 | Local anesthetics with higher fat solubility have longer duration of action | | |

RESULTS

Of the 160 participants, 67.5% were research assistants, 3.1% were specialists and 29.4% were faculty members (Figure 1). 13 different surgical physicians participated in the survey. Among the participants, 44 (27.5%) were anesthetists, 18 (11.3%) were orthopedists, 17 (10.6%) were gynecologists (Table 2). No significant difference was found between the branches and the participants.

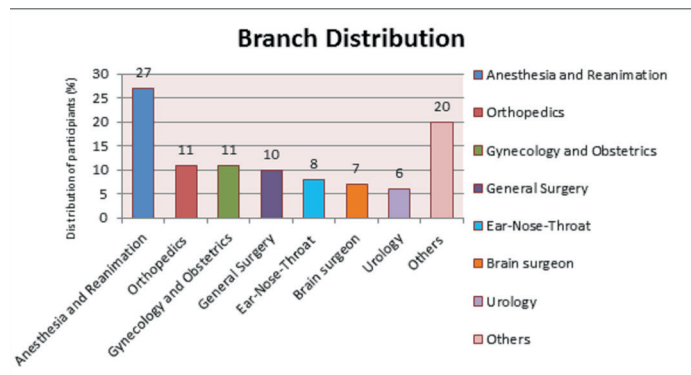


Table 2. Distribution of Participants by Specialty

It was observed that while 68 (42.5%) of the participants used local anesthetics every day, 119 (74.4%) of the physicians mostly preferred subcutaneous/intramuscular route. It was observed that of the 160 participants, 80 (50%) preferred bupivacaine, 89 (55.6%) preferred prilocaine, 84 (52.5%) preferred lidocaine, 73 (45.6) preferred lidocaine + adrenaline and 3 (1.9%) preferred other local anesthetics.

110 (68.8%) of the participants answered 6 or more of the 12 evaluation questions correctly. No significant difference was found between the branches in terms of the percentage of the correct answers. 89 (55.6%) of the physicians stated that they received training on local anesthetics, 53 (33.1%) stated they did not receive any training, and 18 stated (11.3%) they did not remember it (Figure 2). When we look at those who received training among the branches, the percentage of anesthesiologists (86%) who received training was significantly higher than the physicians from the other branches ($p < 0.05$).

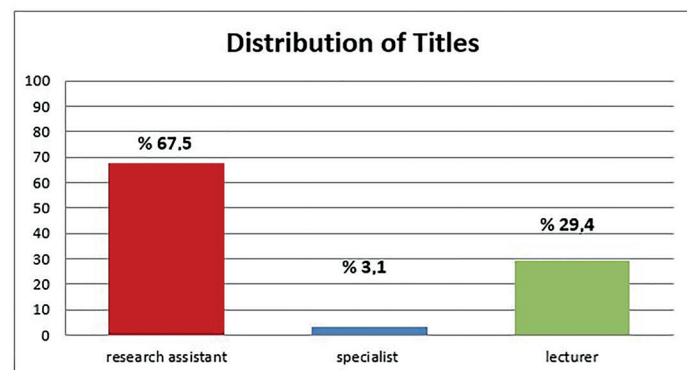


Figure 1. Distribution of physicians participating in the survey according to titles

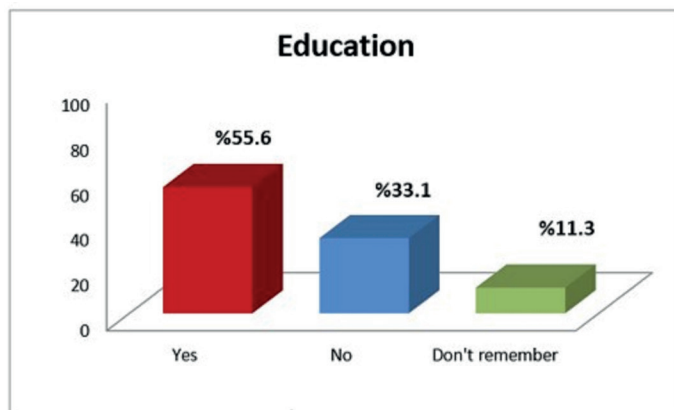


Figure 2. Distribution of Participants' Training on Local Anesthetics

The number of participants who stated that they had never experienced local anesthetic toxicity was 117 (73.1%). As for the local anesthetic toxicity findings, 119 (74.4), 84 (52.5%), 74 (46.3%), and 65 (40.6%) of the participants stated that anaphylaxis, tinnitus, convulsion, and loss of consciousness were the most common findings, respectively.

For the local anesthetic treatment, 86 (53.8%) of the participants stated that their treatment of choice would be 20% lipid infusion, 112 (70%) stated that it would be symptomatic approach, 37 (23.1%) stated that it would be methylene blue, 63 (39.4%) stated that it would be cardiopulmonary resuscitation and 51 (31.9%) stated that it would be antihistamine treatment. According to the answers given, 65 (40.6%) of the participants did not have knowledge about lipid infusion, and 109 (68.1%) did not know whether lipid infusion was available in the hospital. It was observed that 122 (76.3) of the participants did not consider themselves competent about local anesthetics and 135 (84.4%) stated that they wanted to receive training again.

DISCUSSION

This survey study conducted on the surgical physicians of in the university hospital where the research was conducted showed that there is general knowledge about local anesthetics and LATS, but the training given in this field remained insufficient despite the fact that each branch used local anesthetic drugs. It was concluded that the participants received general information about local anesthetics during their medical education, and although they have both theoretical and practical knowledge, most of the physicians were not qualified enough in treatment management, especially when they experienced toxicity.

In a survey on the local anesthetics conducted with the participation of the research assistants working at Research and Training Hospital, the percentage of those who received training on general information about local anesthetics was found to be 29.7% (2). We think that, in this study, similarly to our study, the percentage was low due to the fact that experienced people such as specialists and faculty members were not included in the study. In the same study, the percentage of the physicians

of the Anesthesiology and Reanimation Department who received training was higher compared with the other branches, as was the case with our study. This explains the high training rates in our study.

Although there was a balanced distribution of local anesthetic choices based on the questions asked to the physicians who participated in our study, it was stated that they did not have sufficient information about toxicity doses, and participants stated that although 68% of them used local anesthetics daily, only 12% of them administered a test dose. When the answers of the participants were evaluated, it was seen that intermittent injection and the use of the appropriate dose were considered important among the measures taken to prevent LATS, and they stated that they did not prefer administering test doses and aspiration to prevent unintentional intraarterial injection.

It is known that high doses of local anesthetics in local and regional anesthesia or inadvertent intravenous or intrathecal administration of the local anesthetics pose a risk for toxic reactions. Particularly due to the increasing use of USG in clinical practice in recent years, the guide points used in peripheral nerve blocks adjacent to the vascular structures causing inadvertent intravenous injection of these drugs may cause development of local anesthetic toxicity (7). In order to prevent such cases, the following methods are recommended in a review published by Felice et al. (8) in 2008; (a) slow and intermittent administration of local anesthesia, (b) frequent aspiration, (c) monitoring of the changes in heart rate and blood pressure using low-dose epinephrine with local anesthetics.

As regional anesthesia is applied mostly in the Orthopedics and Traumatology Department as is the case in our clinic, complications such as local anesthetic toxicity are more likely to occur. Literature review revealed similar results and numerous toxicity case reports from Emergency Medicine Departments and Orthopedics and Traumatology Departments (8,9). In our study, although the participants who encountered local anesthetic toxicity the most were Anesthesiology and Reanimation physicians, no significant difference was observed between the departments. This demonstrated that all physicians practicing in the fields of local anesthetics and toxicity should have sufficient knowledge on the subject.

In the study conducted by Başaranoğlu et al. (10), the frequency of encountering local anesthetic toxicity and of administering non-lipid treatments was found to be significantly higher in the anesthesiologists group compared with the other branches. This may be related to the use of local anesthetics more frequently by the anesthesiologist or other branches not having enough knowledge about toxicity symptoms. In our study, 73% of the participants stated that they did not encounter any toxicity before, but they thought that the early findings of toxicity such as anaphylaxis, arrhythmia, and convulsion and the

late findings of toxicity such as the cardiac arrest and nephrotoxicity would be observed more.

In a published review of Beşir (11), it was emphasized that the clinical findings of toxicity due to local anesthetics that are commonly used in oral, dental and maxillofacial surgery should be diagnosed immediately and the necessary equipment should be provided. In addition, it was stated that effective management of the intervention in accordance with the international guidelines on toxicity treatment would reduce the morbidity and mortality.

In addition to the importance of monitoring and close follow-up by intravenous access in patients undergoing local anesthesia, the importance of airway control, ventilation with 100% oxygen, convulsion therapy and use of 20+ intravenous lipid solution (IVLS) with resuscitation in the cardiac arrest in cases with LATS are emphasized in the recent guidelines (12, 13). In our study, 70% of the participants stated that symptomatic approach should be adopted, 30% stated that antihistamines could be used, and 39.4% stated that cardiopulmonary resuscitation could be performed. In addition, while 63.1% of the participants preferred appropriate monitoring in order to prevent local anesthetic toxicity, 81.9% stated that an appropriate dose should be used and 48.1% indicated that intermittent dose should be administered.

Başaranoğlu et al. (10) reported that 65.7% of physicians of all branches had never heard about IVLS treatment related to LATS, and the rate of awareness of anesthesiologists of this treatment was found to be 70.4% in the same study. In the study conducted by Karasu et al. (2), 67.4% of the participants stated that they did not have any information about the treatment, and it was found that while 76.9% of the anesthesia assistants stated that they received training, other branch physicians did not receive any training. In a similar study by Urfalıoğlu et al. (14) with ophthalmologists, it was shown that 20% of the participants selected the option to use IVLS in LATS. In our study, while 33.8% of the participants stated that they never heard about it, 63.7% did not know whether lipid solution was available in the university hospital where the research was conducted.

This study showed that the surgical physicians in the university hospital where the research was conducted do not have sufficient information about the local anesthetics that they use frequently in their daily practice and that may be fatal in case of possible toxicity, and that their knowledge about treatment instructions and the necessary precautions is not sufficient. Increasing training opportunities on such subjects, especially in the post-medical education processes, would be very important for reducing the fatal consequences.

The limitations of this study were the fact that our study was single-centered and that only surgical physicians participated. We believe that multicenter studies should be performed with broad participation especially with different practitioners such as dentists.

LIMITATIONS

This study has potential limitations. Firstly, the number of doctors in other branches is not equal and that the study is single-centered. Secondly, the number of assistant doctors participating in the study is 108. Finally, the professional experience and education levels of those included in the study are not equal

CONCLUSION

Although local anesthetic toxicity is rarely seen, local anesthetics are frequently used in clinical practices. Therefore, practitioners should have knowledge about local anesthetic drugs, maximum doses, side effects, symptoms of toxicity and the necessary treatment in case of toxicity. In addition, we believe that the above mentioned subjects and especially the related guidelines should be included in the annual training programs and practical applications in other clinical branches administering local anesthetics.

Competing interests: The authors declare that they have no competing interest.

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Ethical approval: The included in this single-centered study upon the approval of the Karadeniz Technical University Medical Faculty Ethics Committee (2017/650).

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