

Knowledge of Emergency Medicine Physicians about Local Anesthetic Toxicity and Intravenous Lipid Treatment

Acil Tıp Hekimlerinin Lokal Anestezi Toksikitesi ve İntravenöz Lipit Tedavisi ile ilgili Bilgileri

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ABSTRACT

Objective: To evaluate the knowledge of emergency medicine doctors regarding local anesthetic systemic toxicity (LAST) and intravenous lipid emulsion (LE) used in treatment, and to raise awareness of this issue.

Materials and Methods: A questionnaire consisted of 17 questions about demographics, local anesthetic (LA) use, toxicity, and treatment methods was administered to emergency medicine doctors working at different hospitals.

Results: 181 doctors were included in this survey. Most of the (137 participants, 75.7%) participants were working in state hospitals. Professional experiences of the participants varied. The majority of participants (103 participants, 56.9%) stated that they had not received any training about the use of LAs during their education. Lidocaine was the most preferred local anesthetic agent (75.5%). Majority of the participants stated that their knowledge about the LAs they used was insufficient. Forty-one (22.7%) participants answered that they know the indications and route of LE administration. Nine (5%) participants reported that they have encountered LA toxicity and have used LE. One hundred eighteen participants (65.2%) stated that they do not have LE in their emergency department.

Conclusion: Knowledge about the LA toxicity and lipid emulsion usage in the treatment of LAST is insufficient among emergency doctors. More efforts must be made to improve this issue.

Key Words: emergency medicine; local anesthetic; local anesthetic systemic toxicity; lipid emulsion; lidocaine; therapy.

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ÖZET

Amaç: Lokal anestezi sistemik toksisitesi (LAST) ve tedavisinde kullanılan intravenöz lipit emülsiyonu (LE) ile ilgili acil tıp doktorlarının bilgi düzeylerini değerlendirmek ve bu konudaki farkındalığı arttırmak.

Gereç ve Yöntem: Farklı hastanelerde çalışan acil tıp doktorlarına demografik özellikleri, lokal anestezi (LA) kullanımı, toksisite ve tedavi yöntemleri ile ilgili 17 soru içeren bir anket uygulanmıştır.

Bulgular: Ankete 181 doktor katıldı. Katılımcıların çoğu (137 katılımcı, %75) devlet hastanelerinde çalışmaktaydı. Katılımcıların mesleki tecrübeleri çeşitlilik göstermekteydi. Katılımcıların büyük bölümü (103 katılımcı, %56.9) eğitimleri süresince LA'ların kullanımı ile ilgili herhangi bir eğitim almadıklarını belirtti. Lidokain en çok tercih edilen lokal anestezi ajanı (%75.5). Katılımcıların çoğu kullanmış oldukları LA'larla ilgili bilgi seviyelerinin yeterli olmadığını belirtti. Kırk bir (%22) katılımcı LE kullanımı endikasyonlarını ve kullanım şeklini bildiklerini ifade etti. Dokuz (%5) katılımcı LA toksisitesi ile karşılaştıklarını ve LE kullandıklarını bildirdi. Yüz on sekiz katılımcı (%62.5) acil servislerinde LE bulunmadığını belirtti.

Sonuç: Acil hekimlerinde LA toksisitesi ve LAST'ın tedavisinde kullanılan LE ile ilgili bilgi düzeyi istenen seviyede değildir. Bu konunun geliştirilmesi için daha fazla çaba gerekmektedir.

Anahtar Sözcükler: Acil tıp, lokal anestezi, lokal anestezi sistemik toksisitesi, lipit emülsiyonu, lidokain, tedavi.

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INTRODUCTION

Local anesthetics are widely used in everyday practice. Their applications range from use in outpatient medicine clinics to operation theaters and emergency departments (1). Improving the quality of recovery, decreasing opioid exposure, decreasing postoperative nausea and vomiting, improving patient satisfaction, decreasing the length of hospital stay, and reducing the risk of chronic post-surgical pain are some of the advantages of local anesthetic (LA) applications (2). Emergency physicians come across a wide variety of painful conditions and perform a large number of LAs. Some indications are wound repair, nerve blocks for painful wounds and temporary pain control for non-traumatic conditions. Local anesthetics are also used as a diagnostic tool for eye pain, abdominal pain, and chest pain (3).

The side effects of LAs are most often minor or transient, but occasionally they may be life-threatening and fatal, ranging from mild symptoms to major central nervous system (CNS) involvement and/or cardiac toxicity that can result in disability or death (4). Local anesthetic systemic toxicity (LAST) remains a real danger of regional anesthesia. Though its incidence is less than 0.2% LAST is difficult to treat and is potentially fatal (5). Over the last decade, intravenous infusion of a lipid emulsion (LE) has become part of the treatment for systemic toxicity of LAs, particularly for refractory cardiac arrest (6). The American Society of Regional Anesthesia and Pain Medicine (ASRA) periodically revises and updates its checklist for the management of LAST. The 2017 update proposes to consider lipid emulsion therapy (LET) at the first sign of a serious LAST event (7). Although LAs are widely used, there are not many studies about the knowledge of LAST and use of lipid rescue therapy in emergency departments. In this questionnaire study, we aimed to evaluate the knowledge of emergency medicine doctors regarding LAST and intravenous lipid emulsion treatment and to raise awareness of this issue.

METHODS

The study was approved by the Sütçü İmam University Faculty of Medicine Clinical Research Ethics Committee (approval number 2017/19/10). One hundred eighty-one doctors working in various positions in emergency services were included in the study. Participants were selected from the doctors working at hospitals in different regions of Turkey. The questionnaire form was created on the Google forms platform. Participants were contacted via e-mail and the content of the study was explained and the uniform-resource-locator (URL) of the survey form was shared. Since the clinicians had completed the questionnaire online and the data were analyzed anonymously, there was no informed consent obtained from participants. We asked participants to respond to our survey of 17 questions. The questions consisted of demographic characteristics of the participants such as age, place of employment, position in employment and profession experience. Following questions were about educational status and preferences regarding LA. The questionnaire also included questions about the doses, side effects, and toxicities of LAs used by participants. The last three questions aimed to evaluate the participants' preference and knowledge of lipid solution treatment for the local anesthetic toxicity. Numerical variables were expressed as the mean \pm standard deviation and categorical variables were expressed as frequency and percentage.

RESULTS

All of the participants have completed the survey. All survey questions, frequency and percentage of answers were listed in Table 1. Mean age of the participants was 33.62 ± 5.48 (25-55) years. Most of the participants (137 participants, 75.7%) were working in state hospitals. Professional experiences of the participants varied. The majority of participants (103 participants, 56.9%) stated that they had not received any training about the use of local anesthetics during their education. Lidocaine was the most preferred local anesthetic (75.5%). Majority of the participants stated that their knowledge was insufficient about the doses (102 participants, 56.4%), maximum doses (95 participants, 52.5%), contra-indications (106 participants, 58.6%), complications (103 participants, 56.9%), adverse effects (106 participants, 58.6%) and management of adverse effects (100 participants, 55.2%) of local anesthetics they used. Participants reported that hypotension (88 participants, 48.6%), allergic reaction (86 participants, 47.5%), tachycardia (80 participants, 44.2%) were the most commonly encountered adverse effects of LAs.

One hundred twenty-three (68%) participants have not encountered any LA toxicity. Forty-one (22,7%) participants answered that they know the indications and route of LE administration. Nine (5%) participants reported that they have encountered LA toxicity and have used LET. One hundred eighteen participants (65.2%) stated that they do not have LE in their emergency department.

DISCUSSION

Local anesthetics block intracellular voltage-gated fast sodium channels in neuronal tissue that inhibits depolarization and prevents neuronal transmission. Circumoral numbness, tinnitus, malaise, and muscular twitching of facial and peripheral muscles are generally the first signs of CNS toxicity. The initial symptoms are soon followed by seizures, unconsciousness, coma and then apnea (6). At the myocardial cellular level, LAs block potassium and calcium channels that may cause dysrhythmias, myocardial depression, complete atrioventricular block and cardiac arrest (8).

Local anesthetic systemic toxicity has been found to be more common in very old, teenage and woman patients. Ninety percent of cases involve the more potent LAs, including ropivacaine, bupivacaine, and levobupivacaine (9). It is important to know the preventive methods of LA toxicity. Identification of high-risk patients, appropriate dose, and administration technique are mandatory. Intermittent aspiration and observing the blood in the syringe to avoid intravascular injection and slowly injection of large volume LAs are some simple preventive methods. Maintaining communication with the patient to detect subtle symptoms, such as dysarthria, as well as changes in mental status and consciousness is also important. Adequate monitoring of vital signs is also crucial (10). Adding adrenaline (at a ratio of 1:200000) also decreases and delays the peak plasma concentration of LAs and thus increases their safety. Addition of opioids also allows the use of lower doses of LAs (5). Ultrasound-guided peripheral nerve blockade reduces the risk of vascular puncture and direct intravascular injection (11).

ASRA emphasizes that pharmacologic treatment of LAST is different from other cardiac arrest scenarios. On a LAST event, ASRA proposes to reduce individual epinephrine boluses to ≤ 1 mcg/kg and to avoid vasopressin, calcium channel blockers, beta blockers or other LAs. Local anesthetic injection must be stopped. Preparations for LET must be done. Resuscitation may be prolonged so cardiopulmonary bypass team must be informed. Airway management, controlling seizures, treating hypotension and bradycardia are other steps. In patients less than 70 kg, it is recommended to initiate 20% intravenous LE with a bolus dose of 1.5 mL/kg rapidly over 2-3 minutes and to continue with infusion at ~ 0.25 mL/kg/min. In patients, greater than 70 kg recommended bolus dose is 100 mL 20% lipid emulsion rapidly over 2-3 minutes. Lipid emulsion infusion dose is 200-250 mL over 15-20 minutes. If the patient remains unstable additional recommendations are; re-bolus once or twice at the same dose and double infusion rate. It is important to be aware of the dosing limit (12 mL/kg). Total volume of LE can approach 1 L in prolonged resuscitation. Prolonged monitoring (2-6 hours) is recommended after any signs of LAST, since cardiovascular depression due to LA can persist or recur after treatment (7).

The full rescue effect of LET during LAST is thought to be multimodal. The mechanism of LET based reversal includes both a scavenging effect that removes the drug from tissue and a direct inotropic effect by improving mitochondrial function of cardiac cells and increasing calcium uptake that improves cardiac output once the drug is removed from cardiac tissue (6,12). The cardiotoxic effect only occurs once drug concentrations in cardiac tissue drop below ion channel-blocking thresholds (12).

According to previous surveys the desired level of awareness about LAST and LET is lacking. Başaranoğlu et al. reported that 65.7% of physicians in all branches had never heard of LET (13). Similarly, a survey of residents from all branches conducted by Karasu et al. revealed that 67.4% of the participants had never heard of this treatment (14). Urfalıoğlu et al. evaluated the knowledge of ophthalmologists regarding LAST and intravenous LE used in treatment. They stated that the majority of the participants (62,5%) had not any knowledge about the use of lipids in the treatment of LA toxicity (15). Similarly, in our survey minority of the participants (41 participants, 22.7%) have known when and how to use lipids in the treatment of LA toxicity. Most of the participants didn't have LE in their department (118 participants, 65.2%). The use of LE in LAST is relatively a new issue and is not included in the curriculum of emergency medicine education in our country.

As previously mentioned before, the dose and administration route of the LAs are the main factors for LAST development. Most of the interventions in the emergency medicine departments require a low-dose LA agent.

Table 1: Whole survey questions and frequency and percentage of answers.

Data of the survey participants and their responses regarding local anesthetic use	Number and Percentage of the participants
Place of employment	
State hospital	137 (75,7%)
University hospital	33 (18,2%)
Private hospital	11 (6,1%)
Position in employment	
Specialist	85 (47%)
Assistant doctor	35 (19,3%)
General practitioner	50 (27,6%)
Faculty member	11 (6,1%)
Professional of experience	
0 to 2 years	40 (22,1%)
2 to 4 years	28 (15,5%)
4 to 6 years	42 (23,2%)
6 to 10 years	45 (24,9%)
> 10 years	26 (14,4%)
Did you receive training on local anesthetics?	
Yes	53 (29,3%)
No	103 (56,9%)
Cannot remember	25 (13,8%)
Most preferred local anesthetic	
Lidocaine	133 (73,5 %)
Prilocaine	45 (24,8 %)
Bupivacaine	3 (1,7%)
Knowledge about the doses of local anesthetics	
Very well known	7 (3,9%)
Well known	64 (35,4%)
Little known	102 (56,4%)
Not known	8 (4,4%)
Knowledge about the contraindications of local anesthetics	
Very well known	5 (2,8%)
Well known	61 (33,7%)
Little known	106 (58,6%)
Not known	9 (5%)
Knowledge about the complications of local anesthetics	
Very well known	6 (3,3%)
Well known	62 (34,3%)
Little known	103 (56,9%)
Not known	10 (5,5%)
Knowledge about the maximum doses of local anesthetics	
Very well known	4 (2,2%)
Well known	61 (33,7%)
Little known	95 (52,5%)
Not known	21 (11,6%)
Knowledge about the adverse effects of local anesthetics	
Very well known	5 (2,8%)
Well known	63 (34,8%)
Little known	106 (58,6%)
Not known	7 (3,9%)
Knowledge about the treatment of adverse effects of local anesthetics	
Very well known	5 (2,8%)
Well known	63 (34,8%)
Little known	100 (55,2%)
Not known	13 (7,2%)

On the other hand, Tiernay et al. reported a case of lidocaine-induced LAST in an emergency department. The 35 year-old patient was injected with 50 milliliters of 2% lidocaine for the incision and drainage of a labial abscess. Following the procedure, the patient suddenly got worse and went to the cardiac arrest.

What are the most commonly seen toxicity symptoms of local anesthetics?	
Hypotension	88 (48,6%)
Allergic reaction	86 (47,5%)
Tachycardia	80 (44,2%)
Anxiety	55 (30,4%)
Syncope	32 (17,7%)
Tinnitus	13 (7,2%)
Metallic taste in mouth	29 (16%)
Loss of consciousness	10 (5,5%)
Hypertension	5 (2,8%)
Have you ever encountered local anesthetic toxicity?	
Yes	35 (19,3%)
No	123 (68%)
I am not aware of it	113 (7,2%)
I cannot remember	10 (5,5%)
What do you know about the use of lipids in the treatment of local anesthetic toxicity?	
Never heard of it	50 (27,6%)
I've heard of it, but I cannot recall	53 (29,3%)
I've read a scientific article on this subject	37 (20,4%)
I know when and how it is used	41 (22,7%)
Have you ever used lipid therapy to treat local anesthetic toxicity?	
I have never encountered LA toxicity	148 (81,8%)
I used different treatment when encountered with toxicity	24 (13,3%)
I used lipid therapy to treat toxicity	9 (5%)
Do you have lipid solution in your department?	
Yes	63 (34,8%)
No	118 (65,2%)

The authors suspected lidocaine toxicity and started a 100 mL bolus of 20% lipid emulsion followed by 0.25 mL/kg/minute, for an infusion dose of 930 mL. Despite a complicated hospital course, the patient was discharged home neurologically intact (16). Interventions that require high-dose LA agents such as peripheral nerve blockade in emergency services are becoming increasingly common. Therefore, we think that LAST may be seen more frequently in the future in emergency medicine departments.

Our study has some limitations. Clinicians were invited from different regions of Turkey, but we don't know if there is equal participation from all regions. Another limitation is that the survey responders were working at hospitals in city center. We have no idea about the practices in district.

CONCLUSION

According to our survey, knowledge about the LA toxicity and LE used in the treatment of LAST is insufficient among emergency doctors. More efforts must be made to improve this lack of knowledge.

Conflict of interest

No conflict of interest was declared by the authors.

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