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Is local anaesthesia safe in the hands of our surgical residents? A cross-sectional, questionnaire-based study.

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Abstract

Background: Local anaesthetics are used on regular basis by surgical residents in the absence of anaesthesiologists in operating room. Many of them are unaware of the safe doses of LA and detection and treatment of local anaesthetic systemic toxicity.

Materials and Methods: A questionnaire was formulated and circulated among 150 multi-speciality surgical residents and 106 filled ones were statistically analysed.

Results: The knowledge regarding safe dose of Lignocaine was present in 45.6%, 27.3%, 40% and 25% residents of surgery, orthopaedics, obstetrics and ENT respectively. Though 60% residents were using Bupivacaine the knowledge about safe dose of Bupivacaine was extremely poor among all specialities. Majority residents (40-60%) had the knowledge about symptoms of LAST but only 3-5% were aware about intralipid therapy.

Conclusion: The knowledge amongst all the surgical residents regarding safe use of LA and detection and treatment of LAST and intralipid use is extremely poor and attempts should be made to improve this in order to avoid incidents of and fatalities due to LAST.

Key-words: Local anaesthetics, Local anaesthetic systemic toxicity, awareness, surgical residents.

Introduction

The first clinical use of local anaesthetics (LA) dates back to 1884 when Viennese ophthalmologist Carl Koller performed glaucoma surgery using Cocaine for topical anaesthesia. [1] As the undesirable effects and addictive potential of Cocaine became known, new anesthetic drugs were sought to replace it and Procaine was discovered by Alfred Einhorn in 1904,[2] but soon its weak anaesthetic potency was revealed. Subsequently the pursuit for more effective drugs led to the introduction of Lignocaine, Mepivacaine, Bupivacaine, Prilocaine and Ropivacaine into the anaesthesia practice. Although much safer than their predecessors, these newer drugs are not without side effects and can infact lead to a rare but life-threatening complication – 'Local Anaesthetic Systemic Toxicity (LAST)'.

LAST, though reported to be occurring in 7.5 to 20 per 10,000 peripheral nerve blocks and at about 4 per 10,000 epidural blocks, [3] is often under-reported. The under-reporting may be either due to anaesthesiologists not reporting LAST incidents or non-anaesthesiologists not

recognising the symptoms of LAST and so the actual incidence rate of LAST is not known. LAST encompasses a progressive spectrum of neurological and cardiac effects. Seizures may herald the onset of myocardial depression with progression to ventricular arrhythmias and cardiac arrest that may be refractory to treatment. LAST occurs due to plasma level of drug being in the toxic range. Toxic dose may build up if the total dose exceeds the safe limits or if pharmacodynamics of the drug gets affected in such a way that for even an administered safe dose, the plasma level exceeds the safe limit. Hence the factors known to influence the likelihood of LAST include patient age and co-morbidities, concurrent medications, location and technique of block, specific LA compound and total LA dose. The manifestations of LAST and the outcome may depend upon the timing of detection and adequacy of treatment.

The resident doctors of various surgical specialities use LA drugs on regular basis for minor surgeries, many of which are conducted without the presence of anaesthesiologist inside the operation theatre. It is strongly advisable that persons using LA have a thorough knowledge regarding awareness of LAST, safe doses of LA, mandatory monitoring required, detection of symptoms and signs of LAST, use of Intralipid and supportive treatment steps.

Therefore this cross sectional, prospective, questionnaire-based study was conducted with an aim to detect the awareness amongst the multi-speciality postgraduate surgical residents regarding LAST in terms of safe doses of LA, symptoms of LAST and drug of choice for its treatment .

Materials and methods

The study was conducted over a period of one year at two tertiary care teaching hospitals in our city. Institutional Ethics Committee approval of our hospital and the permissions of the deans of the two hospitals were obtained prior to the study. A questionnaire (appendix 1) was developed by the authors, validated and then distributed among 150 residents of various postgraduate surgical specialties at the two hospitals. A written informed consent signed by all those willing to participate in the study was also obtained. The consent and surgical speciality of the resident doctors were noted and confidentiality was maintained.

Statistical Analysis

The data was analysed using SPSS version 20 (Armonk NY: IBM Inc) and the statistical significance was evaluated at 5%.

Results

During the study duration of one year, 150 questionnaires were distributed among the first, second and third year postgraduate resident doctors of various specialities. The authors received 113 filled questionnaires of which 106 questionnaires were complete and these were then subjected to statistical analysis.

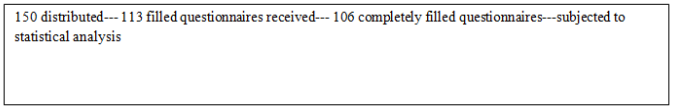

Table 1 shows the distribution of residents as per their postgraduate specialities and year of residency. Of all the 106 residents, 46 (43.4%) were using only Lignocaine as a local anaesthetic and 60 (56.6%) were using Lignocaine as well as Bupivacaine as local anaesthetics.

Table 2 shows the numbers and percentages of residents who had correct knowledge about the safe doses of LA drugs. Noteworthy are the scant percentages of residents of all specialities aware of the safe dose of Bupivacaine. Inter-speciality comparison shows that the differences in knowledge among residents of various specialities are not statistically significant ($P>0.05$).

Table 3 shows that the percentages of residents who felt monitoring was essential during LA administration were 19.6, 4.5, 16.7 and 25 in surgery, orthopaedics, obstetrics

and ENT respectively. Intergroup comparison revealed the difference was not significant statistically with *P*=0.381. Majority of residents who felt the need for monitoring marked blood pressure monitoring as the most appropriate monitor, whereas 3 out of 5 obstetrics residents marked cardiograph monitoring (ECG) as must.

Table 4 shows that the percentages of residents who could tell correctly atleast three symptoms of LAST were 47.8, 45.5, 60 and 50 in surgery, orthopaedics, obstetrics and ENT residents respectively and on intergroup comparison, there was no statistically significant difference between the groups (*P*=0.698).

Table 4 also reveals the extremely poor knowledge regarding Intralipid as the drug of choice for the treatment of LAST among residents of all the specialities

Discussion

Initial reports of local anaesthetic toxicity date back to 1884 after several deaths occurred in patients administered cocaine.[4] Later LAST was reported frequently when numerous fatalities were linked to the use of bupivacaine in IVRA in the 1970s.[5,6] Nowadays though the patients undergoing regional anesthesia are less likely to have LAST than in earlier decades after the introduction of safer and more effective agents ropivacaine and levobupivacaine, its significance cannot be belittled as it still remains a life-threatening and difficult-to-treat complication.

The classic description of LAST consists of CNS excitation, seizures followed by CNS depression which is then followed by cardiac toxicity. With the increase in blood concentration of local anaesthetic levels, cardiac excitation may be followed by cardiac depression. Despite this classic description, atypical presentations are reported in 40% of the published cases of LAST,[4] thus showing extreme variability of its presentation. This stresses the importance of thorough knowledge of symptomatology and extreme vigilance on the part of the clinician administering LA, in order to appreciate the early signs of LAST.

The LAST cases occurring may be due to a lack of knowledge of safe dose of LA, inadvertantly exceeding the safe dose or intravascular injection of LA. Procedures which require a large volume of the LA to be infiltrated (Liposuction), prolonged surgical procedures under LA which may need supplementation of LA during surgery [7] and local infiltration of highly vascular surgical wounds for post-operative analgesia may also lead to occurrence of LAST. [8]

Therefore the study questionnaire included the assessment of knowledge on safe doses of LA and site of maximum absorption of LA as this knowledge is must for any person using LA. Less than 50% residents from each speciality were aware of the safe doses of Lignocaine and Lignocaine with adrenaline and the knowledge was extremely lacking in Orthopaedics and ENT residents. Though 60% residents were using Bupivacaine, only 4.3% and 6.7% of surgery and obstetrics residents respectively were aware of its safe dose. None of the orthopaedics and ENT residents could correctly tell the safe dose of Bupivacaine. Only 26.1 % surgery residents could answer correctly the correct site of maximum absorption of LA. Knowledge was extremely lacking among residents of rest of the three specialities. Blucher *et al,* [9] in a similar study, found that approximately 47.9% surgical trainees could calculate the maximum single safe volume of a particular concentration of LA. Sagir *et al,* [10] in their study, found that 27 % and 25 % of multispeciality surgical residents correctly identified the toxic doses of plain lidocaine and lidocaine with adrenaline respectively. The majority of the residents (93 %) were unaware of the toxic dose of bupivacaine.

If LAST does occur, early detection and timely management are essential to salvage the patient. So the clinician involved in administration of LA should be able

to recognise its symptoms and signs early by using appropriate monitors. We found that only 20% residents in surgery, orthopaedics and obstetrics using LA felt the necessity to monitor patients and the percentage of residents who desired monitoring was highest in ENT (25%). Also amongst those who felt the need for monitoring, only 10% obstetrics residents felt cardiogram was must, all the other residents felt that blood pressure monitoring was sufficient to detect LAST. Blood pressure monitoring alone cannot detect LAST as cardiac depression and hypotension can be a late manifestation of LAST. Cardiogram monitoring is essential to detect tachy-arrhythmias and brady-arrhythmias that can occur in LAST.

The residents aware about the at least three correct symptoms and signs of LAST ranged between 45-60 % in our study. In a study by Sagir *et al* [10], 81 % and 51 % residents correctly identified the signs and symptoms of cardiotoxicity and neurotoxicity, respectively. Only 34 % of these could identify the signs and symptoms of both cardio- and neurotoxicity. In study by Blucher *et al* [9], most trainee surgeons could recognise these signs and symptoms of LA toxicity (61.4%).

Intralipid® 20%, distributed by Fresenius Kabi Ltd. was first introduced in the treatment guidelines for LAST provided by Association of Anesthetists of Great Britain and Ireland (AAGBI) in 2007.[11] Use of intralipid has also been supported by the American Society of Regional Anesthesia (ASRA), and the American Heart Association (AHA) guidelines on LAST treatment. Several case reports demonstrated rapid reversal of LAST with use of ILE often after standard resuscitative efforts had failed.[12] In our study, none of the ENT residents were aware about Intralipid as the treatment of LAST. Among the residents of remaining three specialities, only 3-5% were aware about use of Intralipid. Blucher *et al* [9] reported that only 7.3% surgical trainees were aware of the use of Intralipid® for the management of severe toxicity. Only 2 % of responders knew that lipid emulsion is a part of its treatment in a study by Sagir *et al* [10]. Thus present study shows that the knowledge of lipid rescue therapy is really scant.

Thus our study stresses the lack of knowledge of LA safe doses, that is a part of undergraduate curriculum but that is not reiterated later at the beginning of the surgery residency. With the recent incorporation of the AAGBI guidelines into the Advanced Life Support manuals, a precedent has been set to increase awareness of Intralipid®. [13]

Conclusion

Although residents from various surgical specialities use LA daily, their knowledge regarding the safe doses of LA agents, mandatory monitoring requirements, early detection and treatment of signs and symptoms of LAST and use of Intralipid for treatment of LAST are greatly lacking. Thus for a safe surgical practice using LA, surgery residents need to be thoroughly knowledgeable and well versed with the all aspects of LAST and Intralipid usage specially with regards to its placement in hospital campus and usage regime. A deliberate effort must be made by the departmental heads of surgical specialities as well as head of department of Anaesthesiology to improve this lack of knowledge amongst the postgraduate resident doctors.

References

1. Liljestrand G: Carl Koller and the development of local anesthesia. Acta Physiol Scand Suppl 1967; 299: 3–30.
2. Link WJ: Alfred Einhorn, Sc. D: Inventor of novocaine. Dent Radiog Photog 1959; 32:1, 20.
3. Mulroy MF. Systemic toxicity and cardiotoxicity from local anesthetics: incidence and preventive measures. Reg Anesth Pain Med. 2002;27(6):556–61.

4. Neal JM, Bernards CM, Butterworth JF, Di Gregorio G *et al*. ASRA Practice Advisory on Local Anesthetic Systemic Toxicity. Reg Anesth Pain Med 2010;35: 152-161.
5. Albright GA. Cardiac arrest following regional anesthesia with etidocaine or bupivacaine. Anesthesiology. 1979;51:285-287.
6. Di Gregorio G, Neal JM, Rosenquist RW, Weinberg GL. Clinical presentation of local anesthetic systemic toxicity: a review of published cases, 1979-2009. Reg Anesth Pain Med. 2010;35:179-185.
7. Allman KG, Wilson IH 2006 Oxford Handbook of Anaesthesia (2nd ed) Oxford, Oxford University Press.
8. Parker DA, Coolican MRJ, Mather LE et al. Safety of combined use of local anesthetic infiltration and reinfusion drains in total knee arthroplasty. The Journal of Arthroplasty 2009; 24 (6): 918-24.
9. Blucher N, Pefanis D, Janes C, Ahluwalia R. Do surgical trainees know how to administer local anaesthetic and deal with toxicity? How junior surgeons measure up against their anaesthetic counterparts. The Bulletin of the Royal College of Surgeons of England. 2015;97(2): e4-e8.
10. Sagir A, Goyal R. An assessment of the awareness of local anesthetic systemic toxicity among multi-specialty postgraduate residents. J Anesth. 2015 Apr;29(2):299-302.
11. Weinberg G. Lipid infusion resuscitation for local anesthetic toxicity: proof of clinical efficacy. Anesthesiology. 2006;105:7–8.
12. Weinberg GL. Lipid infusion therapy: translation to clinical practice. Anesth Analg. 2008;106:1340–1342.
13. Picard J, Ward SC, Zumpe R et al. Guidelines and the adoption of ‘lipid rescue’ therapy for local anaesthetic toxicity. Anaesthesia 2009; 64: 122–125.

Figure1. Appendix1. Study questionnaire

Page 1: **Consent Form**

I have been informed that the information in the present questionnaire will be kept confidential and that it may be used strictly for research purpose. I hereby willingly give my consent to participate in the study.

_____

(Signature of Resident)

- Surgical speciality-
- Year of Residency: first/ second/ third

Page 2:

1) Which drug do you routinely use for administering

local anesthesia and in what concentration?

_____

2) The maximum dose of Lignocaine in mg/kg which can be safely administered is _____.

3) The maximum dose of Lignocaine with adrenaline in mg/kg

which can be safely administered is_____.

4) Calculate the maximum volume of 0.5% Bupivacaine which can be safely used in a 10 kg child _____.

5) Do you feel monitoring is necessary while conducting any procedure under local anesthesia?

(i)always (ii) sometimes (iii) never

6) Which monitor would you prefer while conducting procedure under local anesthesia

(i)cardiac monitor (ii) pulse oximeter

(iii) non-invasive blood pressure (iv)any other (specify)

7) What are the sign and symptoms of local anesthetic toxicity? (atleast 3 correct S/S):

8) The specific pharmacological agent for treating local anesthetic toxicity is:

(i) Heparin (ii) Nitroglycerine

(iii) Intralipid (iv) Hydrocortisone

9) The maximum absorption of local anesthetic occurs from :

(i) Subcutaneous tissue (ii) Intercostals

(iii) site of peripheral nerve block (iv) mucous membrane

Table 1. Distribution of Postgraduate Residents as per specialities and year of residency (n = 106).

Sr. No.	Speciality	First year	Second year	Third year	*Total*
1	Surgery	18	15	13	*46*
2	Orthopaedics	06	06	10	*22*
3	Obstetrics	09	12	09	*30*
4	ENT	03	02	03	*08*
	Total	*36*	*35*	*35*	*106*

Table 2. Knowledge assessment and comparison: Safe doses of LA.

Knowledge tested	No. of correct responders (%)				*P*-value*
	Surgery (n=46)	Orthopedics (n=22)	Obstetrics (n=30)	ENT (n=8)	
Safe dose L(2%) (n=41)	21 (45.6)	6 (27.3)	12 (40.0)	2 (25.0)	0.423(NS)
Safe dose L+A (2%) (n=41)	20 (43.5)	5 (22.7)	13 (43.3)	3 (37.5)	0.378(NS)
Safe dose B (0.5%) (n=4)	2 (4.3)	0	2 (6.7)	0	-

L- Lignocaine, L+A- Lignocaine with Adrenaline, B- Bupivacaine, NS- not significant.

Table 3. Knowledge assessment and comparison: Monitoring requirements during LA.

Knowledge tested	No. of correct responders (%)				*P*-value*
	Surgery (n=46)	Orthopedics (n=22)	Obstetrics (n=30)	ENT (n=8)	
Need for monitor (n=17)	9 (19.6)	1 (4.5)	5 (16.7)	2 (25.0)	0.381(NS)
Appropriate Monitors	9- BP (19.6)	1-BP (4.5)	2-BP (6.7), 3-CAR (10.0)	2-BP (25.0)	-

BP- Blood pressure, CAR- cardiogram, NS- not significant

Table 4. Knowledge assessment and comparison: Maximum absorption site, Detection of LAST and Treatment of choice.

Knowledge tested	No. of correct responders (%)				*P*-value*
	Surgery (n=46)	Orthopedics (n=22)	Obstetrics (n=30)	ENT (n=8)	
MAS of LA (n=14)	12 (26.1)	1 (4.5)	0	1 (12.5)	-
Tox S/S (n=54)	22 (47.8)	10 (45.5)	18 (60.0)	4 (50.0)	0.698(NS)
Tox t/t (n=4)	2 (4.3)	1 (4.5)	1 (3.33)	0	-

MAS- maximum absorption site, Tox S/s- toxicity signs and symptoms, tox t/t- toxicity treatment.

Work carried out at: Department of Anaesthesiology, NKP Salve Institute of Medical Sciences, Nagpur

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The manuscript has been read and approved by all authors, requirement for authorship have been met and each author believes that manuscript represents honest work.

Conflict of interest: Nil

Ethics Committee Approval Details:

IEC approval number- IEC/NKPSIMS/61/201

Date of approval: 28-02-2013

Institute name from where IEC approval obtained- NKP Salve Institute of Medical Sciences, Nagpur

Name of Chairperson: Dr. S.C. Karandikar

The ethics committee approval form has been uploaded .