



Knowledge about prudent use of local anaesthetics and awareness about Local Anaesthetic Systemic Toxicity (LAST) among surgical consultants - A cross sectional study

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Abstract

Background: With advent of day care surgeries, the use of local anesthetic drugs has increased manifold. LAST, a serious complication of inadvertent systemic absorption of LA, encompasses a series of neurological and cardiac signs and symptoms which all surgeons should be aware about in order to detect it timely and also treat it using Intralipid therapy and this knowledge is lacking. **Aims and objectives:** Therefore, with an aim to scrutinize this knowledge about basic usage of LA and LAST amongst surgical consultants, this prospective, cross-sectional, questionnaire -based study was conducted. **Methodology:** A questionnaire containing ten questions related to use of LA, symptomatology and treatment of LAST was formulated, validated and distributed amongst consultant surgeons of three teaching hospitals and also among the private practicing surgeons of our city. Completely filled questionnaires were subjected to statistical analysis. **Results:** The results showed scarcity of knowledge about safe doses of LA, need for proper monitoring, recognizing the symptoms and knowledge about Intralipid. Surgeons also had deficient knowledge about use of ultrasound in regional blockade. **Conclusion:** Majority surgeons are routinely using Bupivacaine but due to inadequate knowledge about its cardiotoxic potential, necessity to monitor ECG of patient is lacking. This deficiency in knowledge about LA and LAST is comparable between surgeons of teaching hospital and those doing private practice.

Keywords: local anaesthesia, LAST, Intralipid, surgeons, knowledge

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Introduction: Way back in 1884, when the role of local anaesthetic (LA) drugs was unveiled by Carl Koller, little would have anybody envisioned the vast implications these drugs would ever have in clinical practice. Though these drugs are a boon to surgeons and anaesthesiologists alike, one must bear in mind their potential to cause toxicity, their safe dosages, the manifestations of their toxicity and its management, before actually handling them.

A good number of hospitals is now committed to 'Enhanced Recovery After Surgery (ERAS)' protocol where local anaesthetic techniques play a key role [1]. Use of ultrasonography collaborating with the regional anaesthesiologists has drastically reduced the dose of LA required for loco-regional nerve blocks [2]. Thus, the utility of LA has increased manifold not only by anaesthesiologists but also by surgeons and so cardinal knowledge of LAST becomes imperative.

Local Anaesthetic Systemic Toxicity (LAST) is a sporadic but lethal unfavourable effect of LA which may occur with an incorrect injection of LA, use of an excessive volume or due to its disproportionate systemic absorption and is frequently not diagnosed or stays unreported [3]. LAST encompasses a spectrum of neurological and cardiovascular effects and its timely recognition and treatment is the only way the patient can survive. Unfortunately, a multitude of clinicians tend to confuse LAST with anaphylaxis [4]. Literature search also reveals that precise grasp of LA doses and cognizance of LAST remains deficient among clinical practitioners [5]. What needs to be remembered is that 1 case for every 3 cases of LA toxicity are associated with brain affection and mortality [6].

Intralipid has been mentioned as the specific treatment of LAST in their LAST management guidelines by both the Association of Anaesthetists of Great Britain and Ireland and the American Society of Regional Anesthesia [7] [8].

Therefore, with an aim to scrutinize this knowledge about basic usage of LA and LAST amongst surgical consultants, this prospective, cross-sectional, questionnaire -based study was conducted.

Materials and Methods

The present study was conducted over a period of one year at three tertiary care teaching institutes in our city.

Institutional Ethics Committee approval of the authors' hospital [IEC/NKPSIMS/61/201, dated 28-02-2013, Institute name from where IEC approval obtained- N.K.P. Salve Institute of Medical Sciences & Research centre and Lata Mangeshkar Hospital, Nagpur Name of Chairperson: Dr. S.C. Karandikar] and the permissions of the deans of all the three hospitals were obtained prior to the study.

The surgical consultants of general surgery, orthopaedics, ENT and obstetrics at the three teaching hospitals in our city who consented to participate in the study, along-with consenting private practitioners of the similar specializations were included in the study. Those surgeons unwilling to participate in study were excluded from study. The questionnaires of those surgeons which were incompletely filled were withdrawn from statistical analysis.

The study questionnaire (appendix 1) was developed by the authors, validated and then distributed among consultant surgeons of various specialties mentioned above at the three hospitals. Taking a step further, we also conducted the study amongst private practitioners and so questionnaires were also distributed amongst freelancers of various surgical specialities in our city.

The questionnaire formulated for the study contained 10 knowledge-based questions pertaining to awareness about usage of LA, safe doses, need for monitoring, maximum absorption site for LA and the symptomatology and treatment of LAST. These questions tested the ability of surgeons to safely use LA and recognize and treat LAST in case they encounter it. The tenth question was specifically formulated to know whether surgeons are keeping themselves abreast about the recent advances in regional anaesthesia particularly about the ultrasound guided regional anaesthesia.

A written informed consent signed by all those willing to participate in the study was also obtained. The consent and surgical speciality of the participating surgeon were noted and confidentiality maintained.

The data was analyzed using SPSS version 20 (Armonk NY: IBM Inc) and the statistical significance was evaluated at 5%. Chi square test was used.

Results

During the study duration of one year, 340 questionnaires were distributed among the consultant surgeons at the three teaching hospitals and to the private practicing surgeons. The authors received 320 filled questionnaires of which 308 questionnaires were complete and these were then subjected to statistical analysis. 218 completed questionnaires were obtained from teaching consultant surgeons and 90 from private practitioners.

Table:1 shows the distribution of surgeons as per their specializations. Teaching denotes surgeons working at teaching hospitals and non-teaching denotes private practitioners.

Table 1: Distribution of surgeons as per specialization

Specialization	No.	Teaching(T)	Non-teaching(NT)	Total%
Surgeon	108	75	33	35.06
Orthopedic surgeon	79	61	18	25.64
Gynecology	89	63	26	28.89
ENT surgeon	32	12	20	10.38
Total	308	218	90	100

Table 2 & Table 3 show that knowledge about the commonest LA used, Lignocaine with adrenaline, ranged between 40-60% and although 66% teaching and 71% non-teaching surgeons used Bupivacaine, the knowledge of safe dose of Bupivacaine was highly lacking among both, poorest being among orthopaedic teaching surgeons (13.11%).

Table 2: Knowledge assessment about maximum safe dose of LA

Know ledge tested	Surgeons (n=108) n(%)		Orthopaedicians (n=79) n(%)		Obstetricians (n=89) n(%)		ENT surgeons (n=32) n(%)	
	T(75)	NT(33)	T(61)	NT(18)	T(63)	NT(26)	T(12)	NT(20)
SD-2% L	48 (64.00)	20 (60.60)	36 (59.01)	10 (55.55)	37 (58.73)	14 (53.84)	07 (58.33)	11 (55)
SD-2% L+A	46 (61.33)	21 (63.63)	36 (59.01)	09 (50)	37 (58.73)	14 (53.84)	05 (41.66)	09 (45)
SD-0.5% B	25 (33.33)	12 (36.36)	08 (13.11)	03 (16.66)	15 (23.80)	06 (23.07)	02 (16.66)	03 (15)

T- teaching, NT-non-teaching, SD- safe dose, B- Bupivacaine, L- Lignocaine, L+A- Lignocaine with Adrenaline

Table 3: Association between profession and drug usage

Profession	Drugs usage [No. (%)]		P-value*
	Lignocaine only	Lignocaine & Bupivacaine	
Teaching (n=218)	74 (33.99)	144 (66.05)	0.408(NS)
Non-teaching (n=90)	26 (28.88)	64 (71)	

*Obtained using Chi-square test; NS: Not significant

Table 4 & Table 5 show that only about 34.41% surgeons felt monitoring was needed and out of these majority surgeons (52.59%) felt blood pressure monitoring was required. Only 34.41% surgeons felt the need to monitor ECG.

Table 4: Assessment of perception about need for monitoring the vitals while giving local anesthesia

Need for monitoring local anesthesia	No.	%
Yes needed	106	34.41
Not needed	202	65.58
Total	308	100

Table 5: Distribution of surgeons as per their perception about appropriateness of monitoring

Monitor	No	%
Blood pressure	162	52.59
ECG	106	34.41
Pulse oximeter	40	12.98
Total	308	100

Table 6 shows that 57.79% teaching surgeons and around 60% non-teaching surgeons could correctly tell atleast 3 symptoms or signs of LAST.

Table 6: Association between profession and knowledge of local anesthetic toxicity symptoms/signs

Profession	Local anesthetic toxicity symptoms [No. (%)]		P-value*
	Yes	No	
Teaching(n=218)	126 (57.79)	92 (42.4)	0.769(NS)
Non-teaching(n=90)	54 (60.0)	36 (40.0)	

*Obtained using Chi-square test; NS: Not significant

Table 7: shows that approximately 76% teaching and 73% non-teaching surgeons had no idea about the site of maximum systemic absorption of LA.

Table 7: Association between profession and knowledge about site of maximum absorption of LA

Profession	Site of Max absorption of LA [No. (%)]		P-value*
	Yes	No	
Teaching(n=218)	52 (24.02)	166 (76.14)	0.99(NS)
Non-teaching(n=90)	24 (26.6)	66 (73.3)	

Obtained using Chi-square test; NS: Not significant

Table 8 & Table 9 show that knowledge about treatment of LAST in form of Intralipid therapy was very poor among all specialities, worst among orthopaedicians (5.10%).

Table 8: Association between profession and local anesthetic toxicity treatment

Profession	Local anesthetic toxicity treatment [No. (%)]		P-value*
	Yes	No	
Teaching(n=218)	24 (11.0)	194 (89.0)	0.345(NS)
Non-teaching(n=90)	13 (14.44)	77 (85.55)	

Obtained using Chi-square test; NS: Not significant

Table 9: Association between specialization and knowledge about local anesthetic toxicity treatment

Faculty	Local anesthetic toxicity treatment [No. (%)]		P-value*
	Yes	No	
Surgeon (n=108)	17 (15.7)	91 (84.3)	0.158(NS)
Orthopedic surgeon (n=79)	4 (5.1)	75 (94.9)	
Gynac (n=89)	10 (11.2)	79 (88.8)	
ENT surgeon (n=32)	4 (12.5)	28 (87.5)	

*Obtained using Chi-square test; NS: Not significant

Table 10 shows that knowledge about ultrasonography as an aid to regional anaesthesia for reducing volume of LA was extremely poor with only 7 out of 218 teaching surgeons (3.21%) and 4 out of 90 (4.44%) non-teaching surgeons knowing about it.

Table 10. Association of profession and knowledge about ultrasonography as an aid

Profession	Knowledge about ultrasound	
	Yes	No
Teaching (218)	07 (3.21%)	211 (96.78%)
Non-teaching (90)	04 (4.44%)	86 (95.55%)

There was no statistically significant difference between knowledge of teaching and non-teaching surgeons or between surgeons of various specialties also.

Discussion

It has been estimated that the worldwide rate of LA injection is six million people each day [9]. Modern methods of nerve block, more comprehension about their advantages, and the recent introduction of new LA agents have made their use much more common now, even at the hands of non-anaesthesiologists [10].

Knowledge of safe doses of LA agents is of utmost importance while using these drugs. Although using it on regular basis, majority of surgeons lacked the knowledge about safe dose of Bupivacaine in our study. The prolonged duration of action of Bupivacaine may be the reason for its frequent usage by surgeons but hardly few felt the need to monitor ECG of patients while using this drug with cardiotoxic potential. Sagir *et al* [10], in a cross-sectional questionnaire-based survey with 200 multi-speciality postgraduate residents, 93% of residents had no knowledge about toxic doses of bupivacaine. 27% and 25% of residents rightly answered the questions on unsafe doses of lignocaine and lignocaine with adrenaline, respectively. In a similar study by Yadav *et al* [11] with 200 private practitioner dental surgeons, 78.8 % of the participants had cognition about usage of LA but 6 % of the participants were deficient in knowing that local anaesthetics can be toxic. Blucher *et al* [12] reported that around 47.9% surgical residents could rightly compute the safe volume of a LA.

Mathoorah *et al* [13] accounted that 50.5% of surgical registrars were aware of the maximum dose of bupivacaine. 84% dental surgeons had scarce knowledge of dose calculation in a similar survey by Kaira *et al*[14] . All these studies show how inadequately equipped the surgeons are as goes the comprehension about calculation of safe doses of a routinely used LA, Bupivacaine.

It is said, 'The eyes see only what the mind knows'. Unless the surgeons know about LAST, they are neither going to anticipate it nor recognize the symptomatology. Therein also lies the importance of proper monitoring. The AAGBI announced a novel guideline in 2021 describing that loco-regional anaesthesia necessitates a mandatory monitoring of the heart rate and rhythm, blood pressure and peripheral capillary oxygen saturation before the starting of the procedure and persistent for minimum half an hour after administration of blockade [15]. 72% of the ophthalmologists in a study by Aykut *et al* [16] felt that meticulous tracking of vitals can prevent LAST. Majority of surgeons in our study chose blood pressure monitoring but cardiac depression and hypotension can be a late manifestation of LAST and ideally ECG monitoring is essential to detect tachy-arrhythmias and brady-arrhythmias that can occur early in LAST.

LAST has been classically described to begin with CNS excitation, convulsions followed by a depressant effect on CNS. Later cardiac toxicity ensues with cardiac excitation which is followed by cardiac depression. Atypical presentations are reported in 40% of the published cases of LAST [17]. 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. In our study, although around 60% surgeons could write about atleast three symptoms of LAST, these were all late symptoms related to late cardiovascular collapse, none could tell about early symptoms of LAST. Mathoorah *et al* [13] reported that only 17.6% of the surgical registrars could rightly recognize the entire preliminary symptomatology of LAST, while 43.1% correctly identified all the late signs and symptoms. Of the registrars, 61% knew that bupivacaine is associated with refractory cardiac symptoms.

Worldwide, the Intralipid® (Fresenius Kabi Runcorn, UK), an intravenous lipid emulsion of soya oil, glycerol, and egg phospholipids [18] is the most commonly used treatment for LAST. We saw an extremely poor knowledge about intralipid therapy in our study ranging from 5-15% among various specialities, being least among orthopaedic surgeons. In a study by Surani *et al* [19], all anaesthesia and intensive care residents as opposed to only 50% of the residents of other departments were knowledgeable about Intralipid therapy. Similar findings were also seen in study by McKevith *et al* [20].

As an addition to our previous questionnaire, when knowledge about ultrasound as an aid to reduce volume of LA was tested, the results were very unsatisfactory with only 3-5% surgeons having this understanding.

Conclusions

The study reinforces the observations of our previous study on awareness of LAST among surgical residents. The cognition the surgeons have, about safe doses of LA, perception of early symptomatology of LAST and the awareness of Intralipid therapy for its treatment is grossly scarce. Majority surgeons are routinely using Bupivacaine but due to inadequate knowledge about its cardiotoxic potential, necessity to monitor ECG of patient is lacking. This deficiency in knowledge about LA and LAST is comparable between surgeons of teaching hospital and those doing private practice.

Limitations: Since there was no incentive to the responders, we could not motivate multitude of surgeons for filling the questionnaire. The actual number of completed response sheets

received was much less than that which was circulated. Comparatively less number of private practitioners could be targeted, so results may not be generalized to that population. We could not keep a record of years of training of the surgeons, it could have added a new dimension to the results of our study.

Recommendations: Simulation based training programs greatly help and should be conducted regularly for surgical students and staff. We recommend distribution of online study materials, compulsory conduct of online and offline training programs which need to be followed by assessment exams so that all surgical staff and students keep themselves cognizant about LA usage and LAST while using these drugs. Every institute should have a "LAST RESCUE CORNER", a place where resuscitation kit including Intralipid drug (long expiry period), dosage chart displaying administration plan and other equipment for resuscitation are placed. Whenever possible, anaesthesiologists' help should be sought when high volume LA is being used. A practice of repeated aspiration and then injection every 3-4 ml aliquots of LA should be followed. Lean body weight should be used for large volume local anaesthetic dose calculation, instead of actual body weight.

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Conflict of interest:

The authors have no conflict of interest.

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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 Surgeon)

- **Surgical speciality-**
- **Work place-** Teaching hospital/ private practitioner

Page 2: Questionnaire

- 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) ECG (ii) pulse oximeter
(iii) 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
- 10) Are you aware about the role of ultrasonography in regional anesthesia? If yes, give details_____

Figure 1: Appendix 1. Study questions