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ORIGINAL RESEARCH REGIONAL ANESTHESIA

Awareness of local anesthetic systemic toxicity among postgraduate residents of surgical disciplines, Lady Reading Hospital, Peshawar, Pakistan

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ABSTRACT

Background & objective: Local anesthetic systemic toxicity (LAST) is a rare but fatal adverse event from local anesthesia. Despite the wide use of local anesthetic drugs among surgeons the awareness about LAST has been less assessed in Pakistan. Lady Reading Hospital Peshawar being the biggest hospital of Khyber Pakhtunkhwa province of Pakistan and having biggest Surgery department of the province, its residents needed to be assessed for the safe practice local anesthesia and knowledge of LAST.

To assess awareness of LAST among postgraduate residents. Settings: Surgical Unit of Lady Reading Hospital Peshawar.

Methods: In this cross-sectional study 148 residents of different departments of Surgical Unit of LRH were included in the study through convenience method. A validated questionnaire was used to assess safe practice, basic knowledge of local anesthetics and knowledge of LAST. 1st year Trainees and non-consenting trainees were excluded. Data was analyzed through SPSS V20.

Results: Trainees of all departments demonstrated poor knowledge of local anesthetics and LAST. Most of the trainees used local anesthetic drugs more than 3 times a week. Only 18% of residents had awareness about safe practice of local anesthesia. 26% of residents had adequate basic knowledge of local anesthetic drugs and only 15.6% of residents had knowledge of LAST and its management.

Conclusion: Despite its high usage by residents of Lady Reading Hospital, the overall awareness among residents about safe practice of local anesthesia, toxicity and management of toxicity is poor.

Abbreviations: KAP: Knowledge, Attitudes, and Practices, LA: local anesthesia, LAST: local anesthetic systemic toxicity, LRH: Lady Reading Hospital,

Keywords: LAST (local anesthetic systemic toxicity); Lady Reading Hospital (LRH); Local anesthesia, Awareness

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1. INTORDUCTION

Local anesthetics are used for pain free smooth surgical interventions and other procedures. It is an excellent replacement of general anesthesia provided the conditions are met. Local anesthetics are administered by the anesthetists as well as the surgeons in the selected cases.[1-6] The benefits are widely recognized now as the techniques of neural blockade are more advance and safer with the use of ultrasound, the use of local anesthesia (LA) has increased in the recent times.[7]

Despite all of its safety and advancement, it still possesses a serious risk of unwanted events; the worst of these events being local anesthetic systemic toxicity (LAST). It's a serious adverse effect resulting in severe morbidity and sometimes even death of the patient.[8] So any doctor who performs procedure using local anesthetic agents, whether an anesthetist or a surgeon, must know about prevention, identification and management of LAST. Several studies have shown that many practitioners have a poor knowledge of local anesthetics dosage, safety and poor knowledge of LAST.[9-12] The available data in this regard is limited.

No recent study has been conducted in Pakistan to assess awareness of LAST among the surgeons. This study was designed to assess level of awareness among postgraduate trainees of surgery department of Lady Reading Hospital, Peshawar, Pakistan, and is aimed to assess the knowledge of postgraduate trainees to improve their capacity in terms of dealing with complication including but not limited to the LAST.

2. METHODOLOGY

This observational cross-sectional study was conducted at Anesthesia Department of Lady Reading Hospital Peshawar after ethical approval from institutional Ethical Review Committee. Postgraduate residents of gynecology, general surgery, orthopedics, neurosurgery, ophthalmology, ENT and other surgical disciplines with ≥ 1 year of training, were included in this study. Informed consent was taken before providing them with a validated questionnaire. Non-consenting and first year trainees were not included. The validated questionnaire was adopted from a previous study.[13] The questionnaire included questions about demography, frequency of administration of loc

al anesthetics, doses, routes of administration and monitoring during administration of local anesthetics and the knowledge about LAST.

A sample size of 148 was selected keeping the confidence interval 95%, margin of error 5%, population proportion 50% and population size 240. Sampling was done through non-probability technique. Questionnaire was shared in hard form and through digital communication with trainees of different departments and data collection was stopped when 148 responses were received. Each participant was required to mark his consent before proceeding towards the questions related to research.

Data analysis was done using SPSS v25. Correct answer scored 1 and an incorrect answer scored 0. Average scores and total scores of participants were also analyzed. Trainees of different departments were compared. Statistical tests were applied to see any significance. $P < 0.05$ was taken as significant.

3. RESULTS

The results of the study highlight several key variables that are critical to understanding the awareness and practices related to local anesthetic usage among postgraduate residents. The most important variables included the frequency of local anesthetic usage, knowledge of maximum safe doses correct dose calculation, and awareness of LAST. These variables are central to assessing the residents' competence and the potential risks associated with local anesthetic administration.

Regarding knowledge of maximum safe dosages and precise dose estimations, the study found considerable disparities between departments, with anesthesia residents outperforming their peers in other specialties. This conclusion emphasizes the necessity of focused training programs for bridging knowledge gaps,

particularly in non-anesthesia departments.

The findings of the study are given in four main sections. The first section describes the demographics of the residents who participated and how frequently they used local anesthetic agents. Participants are distributed among departments in a precise manner, with general surgery having the most trainees, followed by gynecology and obstetrics. Other departments included oral and maxillofacial surgery (5), plastic surgery (2), urology (2), cardiovascular surgery (1), and cardiothoracic surgery (2). Most participants were in their third year of training.

There was a large variance in the frequency of local anesthetic use among the departments. The general surgery and ophthalmology residents were at the top.

General surgery had the most residents who used local anesthetics, whereas Ophthalmology had the largest percentage of regular users in a single department. Overall, 84 residents (56.7%) reported using local anesthetics more than three times a week, with just two people doing so once a month. Residents' safe habits were quantified and displayed in both numerical values and percentages.

The second section evaluated residents' knowledge of local anesthetic agents, with an emphasis on two crucial questions: the maximum safe dose of local

Table 1: Year of training of residents from each department.

Year	Surg	Ortho	ENT	GO	Anes	NS	EYE	Others	Total
• 2nd Year	20	0	2	10	2	0	2	0	**36 (22.2%)**
• 3rd year	9	10	4	9	9	7	1	6	**55 (37.1%)**
• 4th Year	9	7	1	10	7	6	1	6	**47 (32.4%)**
• 5th Year	0	6	0	0	0	4	0	0	**10 (6.7%)**
Total	**38**	**23**	**7**	**29**	**18**	**17**	**4**	**12**	**148**

Data presented as numbers; P < 0.05 considered significant
GO - Gynecology & Obstetrics, Anes - Anesthesia, NS - Neurosurgery

anesthetics and the accurate dose calculation. Significant disparities were seen amongst departments, with anesthesia trainees displaying

higher understanding compared to other disciplines. There were no significant differences between trainees from different departments in terms of fundamental understanding of local anesthetics. The correct replies were tallied, and total percentages were computed.

The last section assessed residents' knowledge of LAST using five specific questions. The responses were analyzed and presented quantitatively, with total percentages derived for accurate answers. Once again, anesthesia department trainees outperformed those from other departments. There were no significant variations in LAST knowledge between non-anesthesia departments. These data indicate disparities in knowledge and practices among departments, emphasizing the importance of focused educational programs to raise awareness and promote safe use of local anesthetics.

4. DISCUSSION

Lady Reading Hospital is the largest hospital of Khyber Pakhtunkhwa province and has the largest surgical unit in the province. Use of local anesthetics is very high by residents of surgical department both in emergency and elective surgical cases, as well as in minor OTs. Results of this study shows that knowledge about LAST among postgraduate trainees of LRH is poor.

Very limited studies are conducted to assess the awareness of practitioners or residents about LAST. In Pakistan the data is even more limited. A similar study was conducted in 2019 in Rawalpindi, where awareness was assessed among practitioners as compared to our study, where we assessed knowledge

of postgraduate residents of surgical specialties.[14] In that study it was found that 76% of the practitioners interviewed were unaware of the LAST.

Safe practice during local anesthetic administration is very important. 37% of the residents always aspirate to check if the needle was in any vessel, which is their highest score in any of these questions/practices.

Only 8% of residents calculate safe dose before administering local anesthetic which is quite worrisome.

Asking about any drug allergy is the first question to be asked. Drug allergy to local anesthetic is very rare but there have been cases reported.[15] Taking informed consent before GA is very common around the world while informed consent before LA is considered not important.[16] The result in our study shows that only 6%

of the residents took informed consent before administering LA. On an average 18% of the residents demonstrate safe practice during LA administration.

In another study conducted in Malaysia, more than 90% of trainees were unaware of LAST and its management.[17] It is somewhat similar results to our study where 84.4% of the residents were unaware. In the Malaysian study, they also conducted an awareness session for trainees and their knowledge was again

Table 2: Use of local anesthetic frequency.

Frequency	Surg	Ortho	ENT	GO	Anes	NS	EYE	Others	Total	P Value
More than 3 times a week	22	5	6	12	14	14	4	7	**84 (56.7)**	**> 0.05**
One to three times a week	16	17	1	16	4	3	0	5	**61 (41.2)**	
Once in a month	0	1	0	1	0	0	0	0	**3 (2)**	
Total	**38**	**23**	**7**	**29**	**18**	**17**	**4**	**12**	**148**	

Data presented as numbers; P < 0.05 considered significant
GO - Gynecology & Obstetrics, Anes - Anesthesia, NS - Neurosurgery

Table 3: Safe practice while injecting local anesthetic

Questions	Answers	Surg	Ortho	ENT	GO	Anes	NS	EYE	Others	Total	P-value
Do you Ask the patient about drug allergy?	Always	4	0	0	1	5	2	0	2	14 (9.4)	> 0.05
	Sometime	16	2	1	2	6	2	0	2	31 (20.9)	
	Never	18	21	6	26	7	13	4	8	103 (69.5)	
Do you Take informed consent?	Always	4	0	0	2	2	1	0	1	10 (6.7)	> 0.05
	Sometime	9	14	0	7	11	1	0	3	45 (30.4)	
	Never	25	9	7	20	5	15	4	8	93 (62.8)	
Do you perform needle aspiration?	Always	15	5	1	10	11	6	2	5	55 (37.1)	> 0.05
	Sometime	8	14	2	7	2	4	0	4	41 (27.7)	
	Never	15	4	4	12	5	7	2	3	52-35.1	
Do you calculate safe dose before administration?	Always	5	1	0	2	1	1	0	2	12-8.1	> 0.05
	Sometime	10	14	2	9	11	1	1	2	50-33.7	
	Never	23	8	5	18	6	15	3	8	86-58.1	
Do you monitor vitals during injecting LA?	Yes	8	7	1	7	15	4	0	3	45-30.4	< 0.05

Data presented as numbers; P < 0.05 considered significant
GO - Gynecology & Obstetrics, Anes - Anesthesia, NS - Neurosurgery

assessed after the academic session, which was reported to be improved. In our study we only assessed the residents with their existing knowledge. Another study conducted in India in 2015, showed that majority of the participants (90%) who were residents of surgery were unaware of LAST and its management.[18] Only 18.75% of their participants correctly identified dose of local anesthetic. If this is compared to our study our residents are even poor in identifying toxic dose of local anesthetic. When this knowledge of safe dose is compared to the safe local anesthetic administration practice, only 8% of residents calculate safe dose before injecting. It means that the culture of safe anesthesia practice is also lacking despite a knowledge of the safe dose. On average 26% of our residents had basic knowledge of local anesthetic agents.

When asked about the availability of Inralipid, which is specific antidote for the LAST, only 4 (2.7%) of residents knew about the non-availability of the antidote in LRH. They assumed that it might be available in the pharmacy or Emergency Department. On average 15.6% of residents were aware of LAST toxicity which is very low.

In another study conducted in UK demonstrated that healthcare practitioners did not show adequate knowledge of safe LA knowledge and practice.[19] However, in that study only gyne / obs practitioners were assessed compared to our study which had a broader scope and population.

A similar Knowledge, Attitudes, and Practices (KAP) study conducted in Sri Lanka showed different and somewhat better results compared to our study.[20] They found knowledge of participating doctors to be satisfactory about LAST; around 45% of doctors were aware of LAST management, which is very high as compared to our study. It is pertinent to mention that in the said study more than 40% doctors who participated were the anesthetists. In our study the number of participating anesthetists was lower.

Table 4: Knowledge about local anesthetic used

Question		Surg	Ortho	ENT	GO	Anes	NS	EYE	Others	Total	P Value
Correct dose of local anesthetic you commonly use?	Correct	11	13	3	11	15	6	1	4	**64 (43.3)**	**> 0.0.5**
What is the mass of drug in 10 mL ampule of 0.5% solution?	Correct	1	0	3	0	9	1	0	1	**15 (10.1)**	**< 0.05**

Data presented as numbers; P < 0.05 considered significant
GO - Gynecology & Obstetrics, Anes - Anesthesia, NS - Neurosurgery

Table 5: Knowledge about LAST. 15% of residents have knowledge of local anesthetic systemic toxicity.

Question	Ans	Surg	Ortho	ENT	GO	Anes	NS	EYE	Others	Total	P Value
Have you heard about LAST?	Yes	11	13	1	5	14	5	0	5	54 (36.4)	> 0.05
Which two systems are primarily affected by LAST?	Correct	5	6	1	4	13	4	0	2	35 (23.6)	< 0.0.5
What is the specific antidote of Local anesthetic systemic toxicity?	Correct	1	3	0	0	14	0	0	1	19 (12.8)	< 0.0.5
Where is antidote available in your Hospital?	Correct	0	0	0	0	4	0	0	0	4 (2.7)	< 0.05
Have you read some guidelines about management?	Yes	0	0	0	0	4	0	0	0	4 (2.7)	< 0.05

Data presented as numbers; P < 0.05 considered significant
GO - Gynecology & Obstetrics, Anes - Anesthesia, NS - Neurosurgery

Several studies have shown the incidence of LAST from 0.87 to 1.8 per 1000 peripheral nerve blocks.[21-23] Looking into this figure it seems very rare, but if it is compared to other important anesthetic complication like malignant hyperthermia which occurs during general anesthesia (1 in 5000) or spinal epidural hematoma (1 in 18000), this figure is very high.[21,24,25]

A study conducted on qualified dentists about their awareness of LAST, showed that 17% of the participants knew the sign and symptoms of LAST.[26] Our study also had 5 residents from maxillofacial surgery, and none of them was able to identify sign and symptoms of local toxicity, though the use of LA by the dentists is a routine. All of the 5 residents used LA more than 3 times a week. It was found from analysis that there is no significant difference among different department in terms of their awareness to LAST.

5. LIMITATIONS

The study has significant limitations. First, the sample size was confined to a specific institution, limiting the applicability of the findings to other settings or areas. Second, the study is based on self-reported data, which may contain response bias or mistakes owing to participants' subjective interpretations. Furthermore, the study's cross-sectional methodology restricts its capacity to establish causal linkages or track changes in awareness over time. The study may also lack variety in terms of participant experience levels, specialties, or training backgrounds, which might have an impact on the findings.

Furthermore, using a questionnaire or survey instrument may not adequately capture the breadth of participants' knowledge or practical abilities about LAST. Finally, the study did not take into consideration external factors like as institutional training programs, resource availability, or past exposure to comparable clinical events, all of which may have an influence on awareness. These limitations emphasize the importance of cautious interpretation of the findings and propose opportunities for further research with larger and more varied populations.

6. CONCLUSION

Local anesthesia systemic toxicity is a very serious adverse event, resulting from local anesthetic use. Despite its high usage by the residents of Lady reading Hospital, the overall awareness among residents about safe practice of local anesthesia, toxicity and management of toxicity is poor. Surgery departments need serious intervention to improve knowledge and practice of its residents when it comes to local anesthesia.

7. Data availability

The numerical data generated during this research is available with the authors.

8. Conflict of interest

All authors declare that there was no conflict of interest.

9. Funding

The study utilized the hospital resources only, and no external or industry funding was involved.

10. Authors' contribution

AT: Concept, Conduction of the study work

RW: Conduction of the study work

AV VT: Manuscript Editing

PS: Data collection, Statistical analysis

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