

Assessing the knowledge and awareness of Local Anesthetic Complications among Undergraduate Dental Students in Tamil Nadu, India - A Cross-Sectional Study

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Abstract

Background: In Dentistry, the administration of a Local anesthetic agent (LA), needs to have sound knowledge about the dosage, technique, and composition of the anesthetic used. It is imperative that dental students be aware of the potential complications of local anesthetics and have the adequate knowledge and equipment to handle them. Hence, this cross-sectional study aimed to assess the knowledge and awareness of local complications among dental students. **Methods:** A cross-sectional study was conducted to assess knowledge and practice among 240 dental students about LA complications over 3 months by using a self-administrative questionnaire with four domains, in multiple-choice and correct and incorrect options were interpreted in yes/no format. Data analysis was carried out using the Statistical Package for the Social Sciences for Windows version 20.0 software.

Results: There was no discernible difference in knowledge across the groups. However by comparing groups regarding the year of the study revealed statistically significant differences [P=0.008] only about paraesthesia. Knowledge regarding Nerve block techniques and their complications, around six questions, the difference in knowledge scores between these groups is found to be statistically significant between interns and others. While comparing the knowledge to manage the complications, Interns (77%) stated that the inferior nerve block has a

high aspiration rate and showed statistically significant differences between the students.

Conclusion: The overall knowledge and awareness about local Anaesthesia and its complications were limited among the undergraduates. It should be emphasized with further training courses to update the knowledge of dental students.

Keywords: Complications of Local Anaesthesia, Dental anaesthesia, Nerve blocks

Introduction:

Local anesthetic agents (LA) are drugs used to produce transient and completely reversible loss of sensation in a particular body area without altering general consciousness. In Dentistry, LA produces loss of sensation by a specific nerve block technique for all kinds of dental treatments.¹ In dentistry, local anesthetic can be administered as either block anesthesia or infiltration anesthesia. While block anesthesia usually works in the mandible, infiltration anesthesia is often used in the maxilla. When profound anesthesia cannot be achieved with infiltration and block approaches, supplementary local anesthetic techniques like intra-ligamentary, intra-osseous, intra-pulpal, and interseptal anaesthesia can be used.² LA drugs primarily act by reducing the permeability of ion channels to Na⁺ ions on the nerve membrane. The nerve cell membrane consists of lipid layers, which are hydrophobic barriers, and drugs with high lipid solubility have longer durations of action, potential, and rapid than those with low lipid solubility.³

As with any invasive procedure, unpleasant side effects can emerge after administering dental local anesthesia.⁴ Local anesthetic-related complications can be assessed both locally and systemically. Psychogenic reactions, systemic toxicity, allergy, anaphylactic shock, and methemoglobinemia are common systemic reactions caused by local anesthesia. Pain during injection, needle fracture, prolonged anesthesia, other sensory problems, lack of action, trismus, infection, edema, hematoma, gingival lesions, soft tissue damage, and ocular complications are common local adverse effects linked to local anesthetic.⁵ Less than 1% of cases are known to result in life-threatening hypersensitivity reactions. Relatively high dosages of LAs or the vasoconstrictor agent cause severe and potentially fatal toxic reactions.⁶

Any dentist or dental student who administers an anesthetic agent must have sound knowledge about the dosage, technique, and composition of the anesthetic used. It is imperative that dental students be aware of the potential complications of local anesthetics and have the adequate knowledge and equipment to handle them. Hence, This cross-sectional study aimed to assess the knowledge and awareness of local complications among dental students pursuing in Tamil Nadu, India.

Materials and Methods:

A cross-sectional study was conducted to assess knowledge and practice among dental students about LA complications over 3 months [September 2024 -November 2024]. The ethical approval for the research was obtained from the Institutional Ethics Committee (KIDS/IEC/2024/III/045)

Sample size calculation:

The sample size was calculated with 80% statistical power, $\alpha = 0.05$, 95% confidence interval, 10% margin of error (E), and knowledge regarding local complications (64%) using Gpower software. The ample size was estimated to be about 240 participants, including third-year final-year dental students and Interns. The participants who consented to participate in this study were included. The first-year, and second-year dental students, postgraduate students, teaching staff, and private dental practitioners were excluded from this study.

Questionnaire:

A self-administrative questionnaire with four domains, including demographic information, knowledge regarding components and complications of LA [3 questions], Knowledge regarding Nerve block techniques and their complications [7 questions], and Knowledge about the practice of nerve block techniques and management of its complications [5 questions]. The questionnaire's internal consistency and content validity were both determined to be good (Cronbach's alpha = 0.82). The survey was pilot-tested on six-panel dentists. Their feedback helped us to reframe some questions Each participant was given a copy of the form, which must be completed within the allotted time. The questions were prepared in multiple-choice and correct and incorrect options were interpreted in yes/no format.

Data analysis:

Data analysis was carried out using the Statistical Package for the Social Sciences for Windows version 20.0 software after the data were initially compiled in a Microsoft Excel spreadsheet (IBM Chicago Inc., IL, USA). Descriptive statistics were presented in terms of frequency and percentage values. Pearson's Chi-square Test or Fisher's Exact Chi-square Test was used to compare variable groups. The significance level was set as P values of 0.05.

Results:

Among the 240 participants, third-year students were 39% (n=94), final-year students were 25% (n=60) and the Interns were 36% (n=86). Most of the students from the third year (36%), final year (40%), and interns (37%) responded that the component responsible for the burning sensation after an injection is sodium metabisulfite, and 54% of the third year, 55% of the final year, 60% of interns stated that the allergic component in LA is methylparaben, there was no discernible difference in knowledge across the groups. The vast majority of interns (75%) had indicated that bupivacaine contributes to persistent paraesthesia. The comparison between groups regarding the year of the study revealed statistically significant differences [$P=0.008$] (Table 1)

Table 2 describes the knowledge about the complications due to various nerve block techniques. Most interns have responded highly in all 7 questions and stated that trismus is mostly caused by inferior alveolar nerve block (73%), Trauma to muscle, PH of vasoconstrictor and Haemorrhage results in trismus (74%), and hematoma will result in PSA technique complications (72%). The majority of the surveyed interns answered that diplopia is the type of ocular disturbance caused by the ASA technique (76%). Most of the final year (72%) and interns (81%) answered that the Vazirani-Akinosi (VA) technique causes diplopia. The difference in knowledge scores between these groups is found to be statistically significant.

The students were aware that the aspiration to be done before injecting LA. Regarding The approach indicated for positive aspiration, only interns (26%) correctly answered that redirecting the needle at the injection site to achieve the negative aspiration. Interns (77%) stated that the inferior nerve block has a high aspiration rate and showed statistically significant differences between the students. (Table 3).

Discussion:

This study aimed to assess dental students' knowledge and awareness of local anesthetic complications due to components, and local anesthetic techniques. The goal was to establish a comprehensive foundation that can be utilized to enhance their knowledge and attitude toward this subject. Upon reviewing the existing literature, it was found that only a few more studies have evaluated the knowledge regarding complications associated with their usage and techniques used among dental students.

In the present study, on comparing the study groups regarding knowledge score about the components responsible for adverse effects in LA, all three years stated that methylparaben is responsible for local anesthetic allergy, and no significant difference was found. Allergic reactions to LAs do occur during routine dental treatment and oral and maxillofacial surgery. The reactions vary from mild ones, such as rashes, angioedema, nausea, and itching, to life-threatening ones, such as bronchospasm and respiratory or cardiovascular collapse, necessitating immediate intervention and management. Allergy to methylparaben may account for significant allergic reactions to these LAs as well.⁷

In the present study, only less than half of dental students invariably answered that articaine causes persistent anesthesia. The reporting rate of paresthesia related to articaine is relatively high among all common local anesthetics in dentistry. Many similar studies and reports reflect the high proportion of paresthesia after the use of articaine. After using the articaine, the lingual nerve was more easily damaged than the inferior alveolar nerve. The lingual nerve damage demonstrates more unpleasant symptoms and increases the likelihood of more frequent reporting than inferior alveolar nerve damage.⁸⁻⁹

According to the research findings, a significant proportion of respondents reported that aspiration during all techniques of local anesthesia application is mandatory. This is like a study conducted by Tadin A et al who demonstrated that 66.2% of respondents indicated aspirating only during block anesthesia.¹⁰ The third- and final-year students showed a lack of knowledge about ocular complications from intra-oral local anesthesia suggesting that they

have inadequate knowledge of the local complications of local anesthesia. This is following the study findings of Mangal SK et al¹¹ who stated that knowledge related to ocular complications is limited. Hence from this study, we can infer that there is a significant lack of knowledge among students. This lack of knowledge was more noticed in undergraduate students when compared to interns. The survey's main drawbacks are its small sample size and unicentric research design. The larger number of participants from multiple centres would have been more helpful in assessing the overall knowledge and validating the study in a larger population.

Conclusion:

The overall knowledge and awareness about local anesthesia and its complications were limited among the undergraduates. This subject is of critical importance in dentistry and should be emphasized more in undergraduate and postgraduate education, with further training courses being provided to update the knowledge of dental students.

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TABLE 1: Knowledge regarding components and complications of local anesthesia

S.no.	Questions	III year		IV year		Interns		P value
		Yes	No	Yes	No	Yes	No	
1	Which component of LA agent will be reason for burning on injection a) Methylparaben b) Thymol c) Sodium meta bisulfite d) Adrenaline	36%	64%	40%	60%	37%	63%	0.890
2	Which component of local anesthesia causes allergy? a) Methylparaben b) Thymol	54%	46%	55%	45%	60%	40%	0.182

	c) Sodium meta bisulfite d) Sterile water							
3	Which local anesthetic agent causes persistent parathesia? a) Lignocaine b) Articaine c) Bupivacaine d) Benzocaine	31%	69%	47%	53%	75%	25%	0.008

TABLE 2: Knowledge regarding Nerve block techniques and their complications.

S.no	Questions	III year		IV year		CRR		P value
		Yes	No	Yes	No	Yes	No	
1.	Trismus is most caused by? a) PSA b) MSA c) IANB	32%	68%	78%	22%	73%	27%	0.001
2.	Trismus caused by? a) A. PH of vasoconstrictor & Haemorrhage b) PH of vasoconstrictor, Haemorrhage & Trauma to muscle c) All of the above	51%	49%	20%	80%	74%	26%	0.001
3.	What will be the complications of PSA? a) Facial palsy b) Parathesia of Upper lip c) Hematoma in pterygoidplexus	49%	51%	70%	30%	72%	28%	0.002
4	What is the type of the ocular disturbance caused by ASA? a) Diplopia b) Ptosis c) Transient squint	39%	61%	68%	32%	76%	24%	0.002
5	Temporary blindness complication seen in? a) ASA b) PSA c) IANB	37%	63%	47%	53%	83%	17%	0.002
6	In the mandibular injection technique, which causes diplopia a) Vazirani akinosi b) Gowgates c) Halsted	46%	54%	72%	28%	81%	19%	0.001
7	Middle ear problem complications occur in a) PSA b) Gowgates c) Vazirani akinosi	45%	55%	52%	48%	50%	50%	0.682

Table 3 Knowledge of the practice of nerve block techniques and management of complications.

S.no.	Questions	III year		IV year		Intern		P value
		YES	NO	YES	NO	YES	NO	
1.	Are you aware that aspiration before injecting local anesthesia is mandatory? a) Yes b) No	79%	21%	97%	3%	99%	1%	0.071
2.	If aspiration is positive what is your further approach a) Inject same LA in the same position b) Discard LA	10%	90%	22%	78%	26%	74%	0.058

	c) Reinsert same syringe in different position							
3.	If LA is injected more than the recommended dose or Directly in IV, the complication present clinically is a) Hypotention & Bradycardia b) Seizure c) None	37%	63%	38%	62%	41%	59%	0.0822
4.	If the needle is broken into the injected site deeply there is no harm to the surrounding site, how will you manage? a) Try to remove needle and regular follow up b) Leave the needle and regular follow up	5%	95%	12%	88%	21%	79%	0.017
5.	Which technique has high aspiration rate? a) PSA b) MSA c) ASA d) IANB	39%	61%	60%	40%	77%	23%	0.000