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Original Article

Retrospective analysis of the effect on vital signs of using local anesthesia during dental procedures on patients with epilepsy

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Abstract

Aim: In our study, we investigated the effects of local anesthesia on pediatric epileptic patients' vital signs (temperature, oxygen saturation, pulse, and blood pressure) before, during, and after application.

Methodology: Epileptic patients needing dental treatment who applied to the Department of Pedodontics in the Faculty of Dentistry at Necmettin Erbakan University between January 2021 and July 2022 were included in the study. After clinical and radiographic examination, Necmettin Erbakan University Meram Medical Faculty Pediatric Neurology Department was sent for consultation. Temperature, oxygen saturation, pulse, and blood pressure data were collected before, during, and after anesthesia in 39 procedures performed on 19 patients. Before data analysis, the Kolmogorov–Smirnov and Shapiro–Wilk tests were applied to test the normality of distribution. A paired sample t-test was used to examine the fever, pulse, blood pressure, and oxygen saturation levels of the participants before, during, and after anesthesia. Statistical significance was indicated when $p < 0.05$.

Results: We found a statistically significant difference between the participants' pulse measurements during anesthesia and their pulse measurements post-anesthesia ($p = 0.049$). There was also a statistically significant difference between the participants' pre-anesthesia oxygen saturation measurements and their pre-anesthesia oxygen saturation measurements ($p = 0.042$). Finally, we found a statistically significant difference between the participants' pre-anesthesia oxygen saturation levels and their post-anesthesia oxygen saturation levels ($p = 0.012$).

Conclusion: In patients with a history of epilepsy, attention should be paid not only to the anesthetics used during dental procedures but also to the consequences of dental anxiety. Dental treatments should be planned with the necessary precautions.

Keywords: Epilepsy, local anesthesia, pediatric dentistry, stress, vital signs

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Introduction

Epilepsy, one of the most common chronic neurological diseases that can be seen at almost any age, requires long-term follow-up and significantly affects quality of life (1). The clinical features of epileptic seizures vary according to the type (paroxysmal (recurrent), reversible (temporary), or

abnormal) and region of electrical discharge in the central nervous system (2). Epilepsy affects 0.5–1% of the world's population (3). Increased incidence and prevalence of epilepsy may be associated with low socioeconomic status, limited health benefits, and environmental exposure (e.g., in the case of neurocysticercosis) (4). Epilepsy requires those affected to be compliant with daily drug intake and prepared for physical changes, repetitive medical examinations, acute medical emergencies, and negative effects on quality of life (5). The development and frequency of seizures are affected by the antiepileptic drugs used in treatment, the hypothalamus–pituitary–adrenal axis, and the secretion of sex steroid hormones. Therefore, epilepsy is also affected by hormonal changes due to puberty, pregnancy, and the premenopausal period (6). Among the causes that trigger epileptic seizures are skipping drug doses, changing drug brands, irregular drug intake, insomnia, anxiety, infection, and electrolyte disorders (7).

Local anesthesia is frequently used in dental procedures. Unfortunately, the anesthetics used can modulate or strengthen seizure activity (8). Also, dental anxiety can trigger seizures (7). Local anesthetics may exhibit proconvulsant or anticonvulsant properties due to their membrane-stabilizing effects; in low doses, they reduce cerebral blood flow and metabolism and have anticonvulsant, sedative, and analgesic effects. However, high doses have a proconvulsant effect and reduce the epilepsy threshold in the cerebral cortex, amygdala, and hippocampus, and may cause generalized convulsions (9). For this reason, especially for patients with a history of epilepsy, attention must be paid to the anesthetics used during dental procedures, the consequences of dental anxiety must be considered, and dental treatments must be planned carefully with the necessary precautions.

The literature regarding studies on the effects of local anesthetics applied to epilepsy patients during dental treatments is limited; therefore, in this study, we aimed to investigate the effects of local anesthetics on epileptic patients' vital signs by measuring temperature, oxygen saturation, pulse, and blood pressure before, during, and after applying local anesthesia.

Materials and Methods

Ethics committee approval was received for this study from Necmettin Erbakan University, Faculty of Dentistry Scientific Research Ethics Committee, in accordance with the World Medical Association Declaration of Helsinki, with the approval number: 2022/183).

Epileptic patients needing dental treatment who applied to Necmettin Erbakan University's Department of Pedodontics in the Faculty of Dentistry between January 2021 and July 2022 were included in the study. After clinical and radiographic examination, the patients were sent to the pediatric neurology department for consultation. Dental treatments and procedures that were approved by a neurologist were planned according to relevant recommendations. After obtaining consent from the patients' parents, each patient's temperature, oxygen saturation, pulse, and blood pressure were measured and recorded before, during, and after local anesthesia was administered. We also recorded whether a seizure occurred during the procedure.

We used the following criteria when including patients in the study:

1. The patient was between 5 and 16 years old.
2. The patient was neurologically cleared to undergo dental treatment.
3. The patient exemplified a rating of 3 or 4 on the Frankl Behavioral Scale.
    a. A rating of 3 indicates that the patient allowed treatment, became willing to cooperate with the dentist over time, and accepted the dentist's instructions.
    b. A rating of 4 indicates that the patient cooperated well with the dentist, was interested in dental practices, laughed, and had fun (Frankl et al., 1962).

We used the following criteria when excluding patients in the study:

4. The patient was younger than 5 or older than 16 years old.
5. The patient needed dental treatment that posed a neurological risk.
6. The patient exemplified a rating of 1 or 2 on the Frankl Behavioral Scale.
    a. A rating of 1 indicates that the patient refused treatment, cried heavily, was fearful, or showed clear signs of absolute negativity.
    b. A rating of 2 indicates that the patient was reluctant to accept treatment or was maladaptive, and negative behavioral symptoms were present, but not physical (e.g., sullen, holding back).

Statistical analysis

The SPSS software V23 (IBM SPSS Inc., Armonk, NY, USA) was used for the statistical analysis of the data within the scope of the research. Before the analysis of the data, Kolmogorov-Smirnov and Shapiro-Wilk tests were applied to test the normality of the distribution. According to the results obtained, parametric tests could be applied because the data were not normally distributed, but the sample size was over 30. Paired sample t-tests were used to examine the statistically significant differences between the participants' fever, pulse, blood pressure, and oxygen saturation levels before, during, and after anesthesia. The level of statistical significance in the study was accepted as $p < 0.05$.

Results

Within the scope of the study, the fever levels of 39 patients were measured before, during, and after anesthesia. According to the results of the co-sample t-test, there were no statistically significant differences between the groups ($p > 0.05$) (Table 1).

Before anesthesia, the pulse levels of the patients were 80 at the lowest, 117 at the highest, and the mean was 95.08 ± 12.82. During anesthesia, the pulse levels were 80 at the lowest, 119 at the highest, and the average was 96.51 ± 11.65. After anesthesia, the pulse levels were 78 at the lowest and 127 at the highest, and the average was 95.46±11.78. According to the results of the co-sample t-test, there was a statistically significant difference between the participants' pre-anesthesia heart rate and their pre-anesthesia heart rate ($p < 0.05$). The pulse levels during anesthesia were higher than the pre-anesthesia pulse levels. There was no statistically significant difference between the pre-anesthesia heart rates and the post-anesthesia heart rates ($p > 0.05$). There was a statistically significant difference between the participants' heart rates during anesthesia and post-anesthesia ($p < 0.05$). Pulse levels during anesthesia were higher than they were after anesthesia (Table 2).

Table 1: Comparison of temperature measurements

	N	Min-Max	Average	Std. D.	Difference	p
Pre-anesthesia temperature	39	36.2-36.8	36.53	0.16	0.01	0.645
Temperature while giving anesthesia	39	36.4-36.8	36.54	0.1		
Pre-anesthesia temperature	39	36.2-36.8	36.53	0.16	0.03	0.194
Post-anesthesia temperature	39	36.4-36.8	36.56	0.09		
Temperature while giving anesthesia	39	36.4-36.8	36.53	0.1	0.03	0.152
Post-anesthesia temperature	39	36.4-36.8	36.56	0.09		

Table 2. Comparison of pulse measurements

	N	Min-Max	Average	Std. D.	Difference	p
Pre-anesthesia pulse	39	80-117	95.08	12.82	1.436	0.045*
Pulse while giving anesthesia	39	80-119	96.51	11.65		
Pre-anesthesia pulse	39	80-117	95.08	12.82	0.385	0.851
Post-anesthesia pulse	39	78-127	95.46	11.78		
Pulse while giving anesthesia	39	80-119	96.51	11.65	-1.051	0.049*
Post-anesthesia pulse	39	78-127	95.46	11.78		

The systolic blood pressure levels of the patients were measured before, during, and after anesthesia. According to the results of the co-sample t-test, there were no statistically significant differences between the groups compared ($p > 0.05$) (Table 3). The diastolic blood pressure levels of the patients were measured before, during, and after anesthesia. According to the results of the co-sample t test, there was no statistically significant difference between the groups compared ($p > 0.05$) (Table 4).

Before anesthesia, the oxygen saturation levels of the patients were 93 at the lowest and 100 at the highest, with an average of 97.41 ± 2.06. During anesthesia, the oxygen saturation levels were 83 at the lowest and 100 at the highest, with an average of 96.62 ± 3.56. After anesthesia, the oxygen saturation levels were 94 at the lowest 94 and 99 at the highest, with an average of 96.67 ± 1.32. According to the results of the co-sample t-test, there was a statistically significant difference between the oxygen saturation measurements of the participants before anesthesia and the oxygen saturation measurements during anesthesia ($p < 0.05$). The oxygen saturation levels before anesthesia were higher than they were during anesthesia. There was a statistically significant difference between the oxygen saturation measurements of the participants before anesthesia and the oxygen saturation measurements after anesthesia ($p < 0.05$). Pre-anesthesia oxygen saturation levels are higher than post-anesthesia oxygen saturation levels. There was no statistically significant difference between the oxygen saturation measurements of the participants during and after anesthesia ($p > 0.05$) (Table 5).

Table 3. Comparison of systolic blood pressure

	N	Min-Max	Average	Std. D.	Difference	p
Pre-anesthesia systolic blood pressure	39	10-12	11.21	0.77	-0.179	0.128
Systolic blood pressure while giving anesthesia	39	10-13	11.03	1.16		
Pre-anesthesia systolic blood pressure	39	10-12	11.21	0.77	-0.128	0.281
Post-anesthesia systolic blood pressure	39	10-13	11.08	1.18		
Systolic blood pressure while giving anesthesia	39	10-13	11.03	1.16	-0.051	0.421
Post-anesthesia systolic blood pressure	39	10-13	11.08	1.18		

Table 4. Comparison of diastolic blood pressure

	N	Min-Max	Average	Std. D.	Difference	p
Pre-anesthesia diastolic blood pressure	39	6-10	7.87	.83	-0.051	0.689
Diastolic blood pressure while giving anesthesia	39	6-9	7.82	.97		
Pre-anesthesia diastolic blood pressure	39	6-10	7.87	.83	-0.077	0.555
Post-anesthesia diastolic blood pressure	39	6-9	7.79	.95		
Diastolic blood pressure while giving anesthesia	39	6-9	7.82	.97	-0.026	0.786
Post-anesthesia diastolic blood pressure	39	6-9	7.79	.95		

Table 5. Comparison of oxygen saturation

	N	Min-Max	Average	Std. D.	Difference	p
Pre-anesthesia oxygen saturation	39	93-100	97.41	2.06	-0.795	0.042*
Oxygen saturation while giving anesthesia	39	83-100	96.62	3.56		
Pre-anesthesia oxygen saturation	39	93-100	97.41	2.06	-0.744	0.012*
Post-anesthesia oxygen saturation	39	94-99	96.67	1.32		
Oxygen saturation while giving anesthesia	39	83-100	96.62	3.56	0.051	0.936
Post-anesthesia oxygen saturation	39	94-99	96.67	1.32		

Within the scope of the study, the fever, pulse, blood pressure, and oxygen saturation values of 19 patients who underwent the procedure for the first time and 20 patients who had undergone the procedure before, before, during, and after anesthesia were compared. According to the results, when fever, pulse, and systolic and diastolic blood pressure values were examined, there were no statistically significant differences between the groups ($p > 0.05$).

The mean pre-anesthesia oxygen saturation value of the patients who underwent the procedure for the first time was 98.16±1.57, and the mean value of the patients who had previously had the procedure was 96.70±2.25. There was a statistically significant difference between the two groups ($p < 0.05$). The mean oxygen saturation values of the patients during the first visit were found to be higher. The mean value of oxygen saturation measurements during anesthesia for the patients who underwent the procedure for the first time was 96.74±3.54, and the mean value of patients who had previous procedure experience was 96.50±3.66. There was no statistically significant difference between the two groups ($p > 0.05$). The mean post-anesthetic oxygen saturation measurement value of the patients who underwent the procedure for the first time was 97.11±1.10, and the mean value of the patients who had previous procedure experience were 96.25±1.41. There was a statistically significant difference between the two groups ($p < 0.05$). The mean oxygen saturation values of the patients with the first visit were found to be higher (Table 6).

Table 6. Comparison of oxygen saturation measurement values of the groups

		N	Average	S.D.	p
Pre-anesthesia oxygen saturation	First visit	19	98.16	1.57	0.025*
	Previous experience	20	96.70	2.25	
Oxygen saturation while giving anesthesia	First visit	19	96.74	3.54	0.839
	Previous experience	20	96.50	3.66	
Post-anesthesia oxygen saturation	First visit	19	97.11	1.10	0.042*
	Previous experience	20	96.25	1.41	

Discussion

Dental anxiety is frequently encountered in dentistry practices. A study conducted in 2019, reported that dental anxiety during dental treatments in epilepsy patients may trigger seizures (7). In our study, the vital signs of the patients in the first and repeated sessions were evaluated. Considering the results of the study, only the oxygen saturation values were found to be higher in the pre-anesthesia and post-anesthesia groups at the first visit. On the other hand, no significant difference was found between the first visit and repeated visits in the values of pulse, fever, and blood pressure.

In a study by Pedroviejo et al., it was reported that in systemic toxicity seen in regional anesthesia, seizures are seen in 5/10,000 patients and occur more frequently against bupivacaine (10). In our study, Mepivacaine Hydrochloride (Safecaine, Vem, Ankara, Turkey) was used and no seizures were encountered.

In a study by Pick et al. in 2001, they recommended using local anesthetics that do not contain vasoconstrictors in epilepsy patients (11). Local anesthesia without vasoconstrictor was used in our study.

In a study conducted in 2009, in a retrospective study examining 335 patients with a history of different types of epilepsy who underwent regional anesthesia, epilepsy was observed in 6% (24 patients) of the patients in the perioperative period. In 9 of them, it was stated that the seizures were a result of epilepsy and were not related to the use of local anesthetics. In the other five patients, systemic toxicity caused by the use of local anesthesia could not be ruled out (12). In our study, no seizures were encountered during the procedures.

Perioperative seizures are rare in patients with epilepsy; Although it is usually seen during induction or recovery, it can last up to 72 hours (13). In a study conducted in 2010, Epilepsy was observed in only 6 (2%) of 236 epilepsy cases (partial epilepsy 70.7%, generalized epilepsy 27.1%, unknown cause 2.1%) who underwent general anesthesia for diagnostic and interventional procedures, and benzodiazepine was required in one of these cases. It has been reported that one of these 6 cases had seizures during induction and the others during recovery (14).

The fact that these complications were not encountered in our study is a limitation arising from the narrow sample size. Treatments on more patients are needed.

Conclusions

For patients with a history of epilepsy, attention should be paid to the anesthetics used during the procedure and to the consequences of dental anxiety. Dental treatments should be planned with the necessary precautions.

There are a limited number of studies in the literature on local anesthetics used during dental treatments for patients with epilepsy. Due to the small number of samples in our study, various limitations were encountered, so studies with larger numbers of patients are needed.

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