ORIGINAL RESEARCH

Is It Safe for Patients With Cardiac Channelopathies to Undergo Routine Dental Care? Experience From a Single-Center Study

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***Background*—**Brugada syndrome and long-QT syndrome may account for at least one third of unexplained sudden cardiac deaths. Dental care in patients with cardiac channelopathies is challenging because of the potential risk of life-threatening events. We hypothesized that the use of local dental anesthesia with lidocaine with and without epinephrine is safe and does not result in life-threatening arrhythmias in patients with channelopathies.

***Methods and Results*—**We performed a randomized, double-blind pilot trial comparing the use of 2% lidocaine without a vasoconstrictor and with 1:100 000 epinephrine in 2 sessions of restorative dental treatment with a washout period of 7 days (crossover trial). Twenty-eight–hour Holter monitoring was performed, and 12-lead electrocardiography, digital sphygmomanometry, and anxiety scale assessments were also conducted at 3 time points. Fifty-six dental procedures were performed in 28 patients (18 women, 10 men) with cardiac channelopathies: 16 (57.1%) had long-QT syndrome, and 12 (42.9%) had Brugada syndrome; 11 (39.3%) of patients had an implantable defibrillator. The mean age was 45.9±15.9 years. The maximum heart rate increased after the use of epinephrine during the anesthesia period from 82.1 to 85.8 beats per minute (P=0.008). In patients with long-QT syndrome, the median corrected QT was higher, from 450.1 to 465.4 ms (P=0.009) at the end of anesthesia in patients in whom epinephrine was used. The other measurements showed no statistically significant differences. No life-threatening arrhythmias occurred during dental treatment.

***Conclusions*—**The use of local dental anesthesia with lidocaine, regardless of the use of a vasoconstrictor, did not result in life-threatening arrhythmias and appears to be safe in stable patients with cardiac channelopathies.

***Clinical Trial Registration*—**URL: http://www.clinicaltrials.gov. Unique identifier: NCT03182777. **(*J Am Heart Assoc*. 2019;8: e012361. DOI: 10.1161/JAHA.119.012361.)**

Key Words: anesthesia • arrhythmia • channelopathies • epinephrine • lidocaine

Patients with a compromised cardiovascular system can potentially experience complications caused by the combination of stress caused by a dental procedure and the application of local anesthetics containing vasoconstrictors. The clinical significance of the cardiovascular and hemodynamic changes caused by the release of endogenous catecholamines and the administration of exogenous sympathomimetics with local anesthetic agents has long been a controversial subject in dentistry and medicine and remains a subject of continued study.[1]

Approaches related to the safety of local anesthetics for use during dental procedures in patients with cardiac channelopathies (CChs) are limited by the lack of studies in this rare population. CChs are inherited cardiac arrhythmias resulting from genetic alterations in ion channels involved in the cardiac action potential that may lead to ventricular fibrillation and sudden death in the absence of structural defects.[2,3] The most prevalent CChs are congenital long-QT syndrome (LQTS) and Brugada syndrome (BrS), which account for approximately one third of unexplained sudden deaths.[4,5] Furthermore, these CChs mainly affect

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Clinical Perspective

What Is New?

- Our prospective and controlled double-blinded randomized study demonstrated that the use of 2% lidocaine without a vasoconstrictor and with 1:100 000 epinephrine is safe in the routine dental care of patients with cardiac channelopathies.
- There were no life-threatening arrhythmic events detected, no significant prolongation of the QT interval was observed in patients with long-QT syndrome, and no dynamic electrocardiographic changes occurred in patients with Brugada syndrome.
- Furthermore, there were no significant differences in blood pressure values and anxiety measures observed at the recording time points with and without epinephrine.

What Are the Clinical Implications?

- The results of this study strongly suggest that the use of dental anesthetics is safe for patients with cardiac channelopathies undergoing routine dental care.

young individuals and have implications for family members at risk.

For effective and safe management of these patients, it is crucial to provide a dental treatment environment that is as stress free as possible once specific clinical triggers for arrhythmic events, such as emotional stress, auditory stimuli, or increased vagal tone, have been identified.[6,7] Medical history evaluation and a consultation with the cardiologist should be the initial step of any treatment plan.[8]

Various small-scale studies,[7,9,10] most of which are case-report communications, have demonstrated the feasibility of using local anesthetics in dental procedures for patients with CChs, although these reports were generally retrospective or lacked specific protocols.

Patients with CChs often do not receive adequate care and analgesia because of the potential risk of life-threatening events, such as sustained ventricular tachycardias, implantable cardioverter-defibrillator (ICD) shocks during the intervention, and arrhythmic syncope.[11] Thus, more studies are needed to guide future dental treatment protocols in patients with CChs.

We hypothesized that the use of local dental anesthesia with lidocaine with or without epinephrine is safe and does not result in life-threatening arrhythmias (hemodynamically unstable arrhythmias, sustained ventricular tachycardia, or appropriate device shocks [categorical variables]) in patients with CChs.

Methods

This was a randomized, double-blind pilot trial approved by the Ethics Committee of Hospital das Clinicas HCFMUSP, Faculdade de Medicina, Universidade de São Paulo (18221913.5.0000.0068). Patients with inherited CChs treated at the Heart Institute of the same university were included after reading and signing the written informed

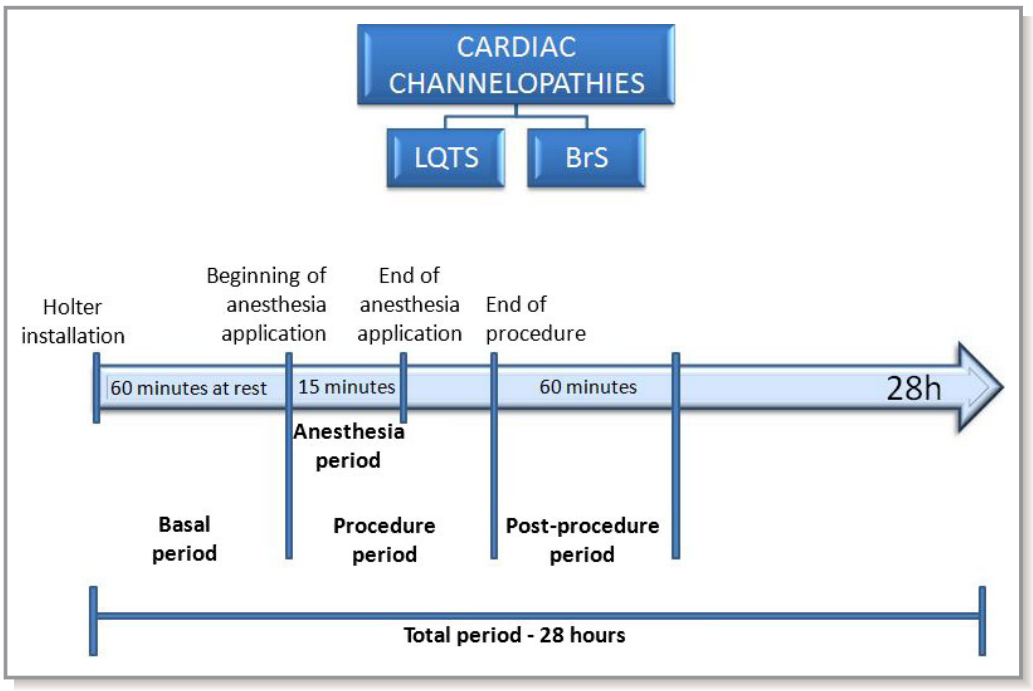

Figure 1. Central illustration with dental procedure study periods. BrS indicates Brugada syndrome; LQTS, long-QT syndrome.

Table 1. Baseline Conditions of Patients With LQTS

Patient No.	Sex	Age, y	ICD	Prevention	Symptoms	FH	Gene Variants	Type	QTc	Schwartz Score[15]
2	M	48	No	. . .	Asymptomatic	Yes	*KCNH2*	2	449	5
7	F	74	No	. . .	Syncope	Yes	*KCNQ1*	1	510	4
12	F	67	Yes	Secondary	ACA	Yes	*KCNH2*	2	500	4
17	M	16	No	. . .	Asymptomatic	Yes	*KCNH2*	2	471	3.5
19	F	35	No	. . .	Syncope	Yes	*KCNH2*	2	496	6
20	F	62	No	. . .	Asymptomatic	No	*KCNQ1*	1	490	4
21	F	41	Yes	Secondary	ACA	No	Unknown	1	566	4
22	F	36	Yes	Primary	Asymptomatic	Yes	*KCNQ1*	1	554	5
23	M	28	Yes	Primary	Syncope	No	*KCNH2*	2	540	5.5
24	F	26	No	. . .	Asymptomatic	Yes	Unknown	Induced	460	5
25	F	49	No	. . .	Asymptomatic	No	*KCNH2*	2	460	4.5
26	M	17	Yes	Secondary	ACA	No	*KCNH2*	2	580	6
27	F	53	Yes	Secondary	ACA	Yes	Unknown	1	478	4
29	F	41	Yes	Secondary	ACA	Yes	*KCNH2*	2	540	5
30	M	65	No	. . .	Asymptomatic	Yes	*SCN5A*	3	530	4
32	F	66	No	. . .	Syncope	No	Unknown	Induced	480	4

ACA indicates aborted cardiac arrest; F, female (women); FH, family history (sudden cardiac death or channelopathy); ICD, implantable cardioverter-defibrillator; LQTS, long-QT syndrome; M, male (men); QTc, corrected QT.

consent form. This study was registered at ClinicalTrials.gov (ID: NCT03182777). To minimize the possibility of unintentionally sharing information that can be used to reidentify study subjects, a subset of the data generated in this study is available at ClinicalTrials.gov and can be accessed at https://clinicaltrials.gov/ct2/show/NCT03182777?term=NCT03182777&rank=1.

The inclusion criteria were as follows: patients with CChs (LQTS and BrS) who were receiving optimal drug therapy, with or without an ICD, and who had dental caries or unsatisfactory restorations in the mandible, indicating restorative dental treatment. The exclusion criteria included an allergy to lidocaine, sodium metabisulfite, or methylparaben; patients with recurrent syncope or sustained arrhythmias documented

Table 2. Baseline Conditions of Patients With BrS

Patient No.	Sex	Age, y	ICD	Prevention	Symptoms	FH	Gene Variant	BrS Type
3	F	44	No	. . .	Palpitations	No	Unknown	1 Induced
4	M	42	No	. . .	Palpitations	Yes	Unknown	1 Spontaneous
5	M	51	Yes	Secondary	ACA	No	Unknown	1 Spontaneous
6	M	67	No	. . .	Asymptomatic	No	Unknown	1 Spontaneous
8	M	46	No	. . .	Asymptomatic	No	Unknown	1 Spontaneous
9	M	52	No	. . .	Asymptomatic	Yes	Unknown	2
10	F	16	No	. . .	Syncope	Yes	Unknown	1 Induced
11	M	39	Yes	Primary	Syncope	Yes	Unknown	1 Spontaneous
13	F	62	Yes	Primary	Palpitations	Yes	Unknown	1 Spontaneous
14	M	51	No	. . .	Asymptomatic	No	Unknown	1 Spontaneous
15	M	41	Yes	Primary	Palpitations	Yes	Unknown	1 Induced
31	M	51	No	. . .	Asymptomatic	Yes	Unknown	1 Induced

ACA indicates aborted cardiac arrest; BrS, Brugada syndrome; F, female (women); FH, family history (sudden cardiac death or channelopathy); ICD, implantable cardioverter-defibrillator; M, male (men).

Table 3. Description of Drugs Used by the Sample Patients

Treatment Medications	Description (N=28)
β-Blockers	17 (60.7)
Calcium channel blockers	6 (21.4)
Quinidine	2 (7.1)
Cilostazol	2 (7.1)
Angiotensin-converting enzyme inhibitor	8 (28.6)
AT1-receptor blockers	4 (14.3)
Diuretics	3 (10.7)
Central-acting agents	2 (7.1)
Direct-acting vasodilator	1 (3.6)
Statins	11 (39.3)
Fibrate	1 (3.6)
Oral hypoglycemic agent	1 (3.6)
Insulin	1 (3.6)
Levothyroxine sodium	1 (3.6)
Oral antacids	7 (25)
Antidepressants	5 (17.9)
Anxiolytics	4 (14.3)
Anticonvulsant	1 (3.6)
Oral anticoagulant	1 (3.6)

Data are given as number (percentage).

for at least 3 months, including ICD shocks; patients who had received epinephrine in the previous 24 hours; and patients with a body weight <20 kg (a child ≈6 years old because of the maximum safe dose of lidocaine, 4.4 mg/kg, used in 2 anesthetic cartridges).[12]

Patients were submitted to 2 sessions of restorative dental treatment with a washout period of 7 days. The same patients were further used as their own controls (crossover trial). We compared the use of a mandibular nerve block with 2 cartridges (3.6 mL) of 2% lidocaine (72 000 μg of lidocaine) without a vasoconstrictor and 2 cartridges of 2% lidocaine with 1:100 000 epinephrine (36 μg of epinephrine) in all patients, resulting in 2 conditions. The carpule syringe was covered with sterile aluminum foil by one of our research team members so the patient and the dentist performing the procedure were blinded to the presence or absence of epinephrine.

The double-blinded randomization of the anesthetic solution application was accomplished by using a randomization program developed in Excel (Microsoft Office) by our research team.

Monitoring

Patients were monitored by a 3-channel (V1, V3, and V5 equivalent leads) Holter monitor (SEER Light Extend; GE Healthcare Brazil) for 28 hours, starting 1 hour before the procedure, for the registration and analysis of cardiac electrical activity during 2 sessions. The electrocardiographic variables studied included the occurrence and frequency of ventricular and supraventricular arrhythmias, identified on a minute-by-minute basis over the 28-hour study period (basal period, anesthesia period, procedure period, and postprocedure period [Figure 1]). The minimum, medium, and maximum heart rates (HRs) were also recorded.

The 12-lead electrocardiography, digital sphygmomanometry (blood pressure [BP]), and assessment of the Facial Image Scale[13] for anxiety were also recorded at 3 time points during the dental treatment (at the beginning of the basal period, 15 minutes after the anesthesia application, and at the end of the procedure).

In patients with LQTS, the QT interval was manually measured using the tangent method from the beginning of the QRS complex to the end of the T wave from all 12 leads. Whenever the end of the T wave could not be determined in any given lead, this lead was excluded from the analysis. The corrected QT (QTc) interval was calculated preferably in lead II, or V2 and V5, using Bazett's formula (QTc=QT interval/RR interval). QTc values >460 ms for women were considered abnormal.[14] All measurements were made by the same cardiologist NQSO, who was blinded to the patients' data, and the measurements were later confirmed by a second cardiologist FCCD. Occasional disagreements were resolved by consensus. All patients were exposed to epinephrine, and changes in QTc (categorized in >10% of shortening or lengthening of QTc) were analyzed.

Dynamic changes in the right precordial leads in patients with BrS and ventricular/supraventricular arrhythmia frequency and device shocks in all patients were also analyzed.

Objectives

The primary objective was to verify the safety of the use of local dental anesthesia with lidocaine with or without epinephrine, which was defined as no occurrence of life-threatening arrhythmias (hemodynamically unstable arrhythmias, sustained ventricular tachycardia, or appropriate device shocks [categorical variables]) in selected patients with CChs. The secondary objectives were to analyze the frequency of occurrence of ventricular and supraventricular arrhythmias using the Holter monitoring system; to analyze the electrocardiographic aspects before, during, and after the procedures (including the measurements of QTc interval in patients with LQTS and the behavior of the morphological pattern of patients with BrS); and to record BP and anxiety scale data (before, during, and after the procedures).

Statistical Analysis

We did not calculate the sample size because of the exploratory nature of this small cohort pilot study.

Table 4. Mean, SD, Median, Minimum, and Maximum HR and Density of Arrhythmias of the Sample During a 28-Hour Period, in Conditions Without and With Epinephrine

28-h Period	Without Epinephrine	With Epinephrine	Difference Between the Pairs	*P* Value
Minimal HR, bpm				0.108
Mean±SD	55.1±10.3	53.7±11.2	1.39±4.43	
Median (minimum; maximum)	55.5 (39; 86)	52.5 (36; 88)	. . .	
Medium HR, bpm				0.060
Mean±SD	77±10.4	75.2±10	1.82±4.91	
Median (minimum; maximum)	77.5 (55; 98)	74.5 (56; 92)	. . .	
Maximum HR, bpm				0.355
Mean±SD	124.9±21.3	122.4±14.9	2.5±14.07	
Median (minimum; maximum)	124.5 (80; 182)	126.5 (87; 144)	. . .	
SVPB				0.978*
Mean±SD	0.79±1.56	0.8±1.88	−0.01±1.17	
Median (minimum; maximum)	0.2 (0; 7)	0.1 (0; 9.2)	. . .	
VPB				0.196*
Mean±SD	3.69±7.73	16.91±74.95	−13.22±72.49	
Median (minimum; maximum)	0.2 (0; 26.9)	0 (0; 397.8)	. . .	
NSVT, n (%)	1 (3.6)	2 (7.1)	. . .	>0.999†
NSAT, n (%)	6 (21.4)	4 (14.3)	. . .	0.625†

Bpm indicates beats per minute; HR, heart rate; NSAT, nonsustained atrial tachycardia in 28 hours; NSVT, nonsustained ventricular tachycardia in 28 hours; SVPB, supraventricular premature beats per hour; VPB, ventricular premature beats per hour.
Paired Student's *t* test is related to *P* value numbers without symbols (0.108; 0.060; 0.355).
*Wilcoxon signed-rank test.
†McNemar test.

Furthermore, because of lack of any data in the literature, we could not estimate the real incidence of arrhythmias with the use of local dental anesthetics in patients with channelopathies.

Initially, all variables were analyzed quantitatively. The quantitative analysis that followed included the observation of the minimum and maximum measured parameter values and the calculation of means, SDs, and medians. The absolute and relative frequencies of all qualitative variables were also calculated. The paired Student *t* test was used for comparison between 2 groups in relation to the means. When the normality assumption was rejected, the Wilcoxon signed-rank test was used. Spearman's correlations between arterial pressures and anxiety scores at the specific study time points were calculated to verify the existence of a correlation between them. The McNemar test was used to verify the electrocardiographic pattern in patients with BrS between the study sessions and the number of patients who had an episode of nonsustained ventricular tachycardia or nonsustained atrial tachycardia. The level of significance was set at 5%, and all tests were two tailed. Statistical analysis was performed using the SPSS (Statistical Package for the Social Sciences), version 20.0 (SPSS, Inc, Chicago, IL).

Results

From May 2016 to August 2018, 70 patients were contacted and 43 were evaluated. Of these patients, 29 were submitted to dental treatment in 2 sessions. One patient was excluded because of loss of Holter recording data.

Fifty-six dental procedures were performed in 28 patients (20 men, 18 women) with CChs: 16 (57.1%) had LQTS, and 12 (42.9%) had BrS; 11 (39.3%) of patients had an ICD. The mean age was 45.9±15.9 years; 20 patients (71.4%) were white. All patients were also receiving antiarrhythmic drug treatment and were in stable condition for the preceding 3 months before the dental treatment (Tables 1[15] through 3).

The duration of dental procedures ranged from 32 to 93 minutes, with an average of 54±13 minutes. All patients received 2 cartridges of anesthetics in both sessions. There were no complaints of pain during the treatment. The dental treatment was well tolerated by the patients, with no onset of symptoms or complications that required the interruption of the procedure.

The numbers of supraventricular and ventricular premature beats per hour were observed with the Holter monitor in both conditions (with and without epinephrine) during the study

Table 5. Mean, SD, Median, Minimum, and Maximum HR and Density of Arrhythmias of the Sample During Basal Period, in Conditions Without and With Epinephrine

Basal Period	Without Epinephrine	With Epinephrine	Difference Between the Pairs	*P* Value
Minimal HR, bpm				0.116
Mean±SD	61.3±10.2	59.4±11.6	1.89±6.16	
Median (minimum; maximum)	61 (39; 90)	59.5 (37; 89)	. . .	
Medium HR, bpm				0.255
Mean±SD	71.7±10.6	70±12.1	1.71±7.79	
Median (minimum; maximum)	72.5 (46; 93)	72.5 (47; 91)	. . .	
Maximum HR, bpm				0.859
Mean±SD	93±13.9	92.7±16.5	0.36±10.56	
Median (minimum; maximum)	92.5 (55; 121)	92 (61; 135)	. . .	
SVPB				0.574*
Mean±SD	0.75±2.29	0.54±1.29	0.21±2.23	
Median (minimum; maximum)	0 (0; 12)	0 (0; 6)	. . .	
VPB				0.506*
Mean±SD	1.89±5.32	26.86±130.88	−24.96±131.16	
Median (minimum; maximum)	0 (0; 23)	0 (0; 694)	. . .	
NSVT, n (%)	0 (0)	1 (3.6)	. . .	>0.999**
NSAT, n (%)	1 (3.6)	0 (0)	. . .	>0.999**

Bpm indicates beats per minute; HR, heart rate; NSAT, nonsustained atrial tachycardia in 60 minutes; NSVT, nonsustained ventricular tachycardia in 60 minutes; SVPB, supraventricular premature beats per hour; VPB, ventricular premature beats per hour.
Paired Student's *t* test is related to *p* value numbers without symbols (0.116; 0.255; 0.859).
*Wilcoxon signed-rank test.
**McNemar test.

periods, with no significant difference between them ($P>0.05$) (Tables 4 and 5).

The maximum HR was increased in the epinephrine patient group from 82.1 to 85.8 beats per minute ($P=0.008$) compared with those without epinephrine (Table 6 and Figure 2).

No sustained arrhythmias were observed in any patient, as also no life-threatening arrhythmic events occurred during dental treatment, regardless of the type of anesthesia. No patient with an ICD received device shocks during the procedures.

In patients with LQTS, the QTc measurements were statistically higher at the end of anesthesia with epinephrine (465.4 versus 450.1 ms; $P=0.009$) (Table 7).

All patients with LQTS were exposed to epinephrine, and changes in QTc (categorized in >10% of shortening or lengthening of QTc) occurred in only 2 patients, shortening this interval after administration of anesthesia (Table 8). None of 16 patients with LQTS had life-threatening arrhythmias.

Of the 12 patients with BrS, 10 had the same electrocardiographic pattern in both conditions, with and without epinephrine, during the studied 3 moments: 2 presented type 1 pattern, and 8 presented non–type 1 pattern. According to patients with BrS submitted to the dental procedure, only in 2 of 12 were the electrocardiographic changes demonstrated, without any life-threatening events. These changes were related to the morphologic aspects (type 1 versus no type 1 patterns) that occurred independently of the use of epinephrine (Table 9).

There were no significant differences in systolic and diastolic BP values observed at the recording time points with and without epinephrine (Table 10).

There were no significant differences in anxiety measures observed at the recording time points with and without epinephrine (Table 11).

There was no statistically significant correlation between anxiety and BP (Table 12). The order of procedure execution influenced the anxiety measures. It was statistically higher in the first session than in the second one at the beginning of the anesthesia ($P=0.038$) (Table 13).

There were no missing measurements in the study data analysis.

Discussion

No life-threatening arrhythmic events were observed during dental treatments under local anesthesia, suggesting that the use of epinephrine at ideal doses is safe for patients with

Table 6. Mean, SD, Median, Minimum, and Maximum HR and Density of Arrhythmias of the Sample During Anesthesia Period, in Conditions Without and With Epinephrine

Anesthesia Period	Without Epinephrine	With Epinephrine	Difference Between the Pairs	*P* Value
Minimal HR, bpm				0.950
Mean±SD	60.3±9.6	60.3±10.1	0.07±6	
Median (minimum; maximum)	59 (41; 89)	59.5 (41; 89)	. . .	
Medium HR, bpm				0.232
Mean±SD	67.7±8.7	69.1±10.1	−1.39±6.03	
Median (minimum; maximum)	67.5 (47; 91)	71 (49; 91)	. . .	
Maximum HR, bpm				0.008
Mean±SD	82.1±11.4	85.8±15	−3.71±6.92	
Median (minimum; maximum)	81.5 (58; 105)	87 (58; 113)	. . .	
SVPB				0.054†
Mean±SD	0.14±0.76	1.43±3.48	−1.29±3.62	
Median (minimum; maximum)	0 (0; 4)	0 (0; 16)	. . .	
VPB				0.465†
Mean±SD	7±34.7	26.7±130.5	−19.71±135.65	
Median (minimum; maximum)	0 (0; 184)	0 (0; 692)	. . .	
NSVT, n (%)	0 (0)	1 (3.6)	. . .	>0.999‡
NSAT, n (%)	0 (0)	0 (0)	. . .	§

Bpm indicates beats per minute; HR, heart rate; NSAT, nonsustained atrial tachycardia in 15 minutes; NSVT, nonsustained ventricular tachycardia in 15 minutes; SVPB, supraventricular premature beats per hour; VPB, ventricular premature beats per hour.
Paired Student's *t* test is related to *p* value numbers: 0.950; 0.232; 0.008.
†Wilcoxon signed-rank test.
‡McNemar test.
§No cases to estimate.

CChs, given that various clinical conditions are met, such as controlled medical therapy and/or no ICD therapy within the preceding 3 months.

No significant prolongation of the QT interval and no life-threatening arrhythmic events were observed in 16 patients with LQTS. We observed QTc shortening in 2 patients with LQTS, which may actually corroborate the safety of these anesthetics used in this population in our study protocol.

No dynamic changes occurred in the right precordial leads of the patients with BrS. Of the 12 patients with BrS, 10 had the same electrocardiographic pattern in both conditions, with and without epinephrine, during the studied 3 time points: 2 presented type 1 pattern, and 8 presented non–type 1 pattern. Only in 2 of 12 patients with BrS undergoing the dental procedure, electrocardiographic changes were observed without any life-threatening events. These changes were related to the morphologic aspects (type 1 versus non–type 1 patterns) that occurred independently of the use of epinephrine.

According to Wynn,[9] the effect of local anesthetics used in dentistry and its association with epinephrine in patients with a history of congenital or acquired QT interval prolongation remain unknown. The formulation of 4% articaine with epinephrine at a concentration of 1:200 000 could benefit patients with a history of cardiovascular disease (including LQTS) and patients who require a vasoconstrictor because of the reduced cardiovascular stimulation produced at that concentration compared with that at a concentration of 1:100 000.

The literature on local anesthetic use in patients with CChs is only limited to a few case reports. Lidocaine with epinephrine at a concentration of 1:100 000 was used as a local anesthetic for dental treatment in a patient with BrS in a case report by Theodotou and Cillo,[10] who described a 55-year-old patient with an ICD, valvular heart disease, and BrS, subjected to abscess drainage and exodontia under general anesthesia. Fifteen milligrams of lidocaine with 1:100 000 epinephrine was applied in the intraoral region for local anesthesia of the operated area. No intraoperative complications or adverse cardiac events occurred.

Rochford and Seldin[7] contraindicated the use of local anesthesia with epinephrine. They reported the case of an 8-year-old child with LQTS submitted to dental extraction under general anesthesia. Local anesthesia with 3% mepivacaine without a vasoconstrictor was administered for the dental

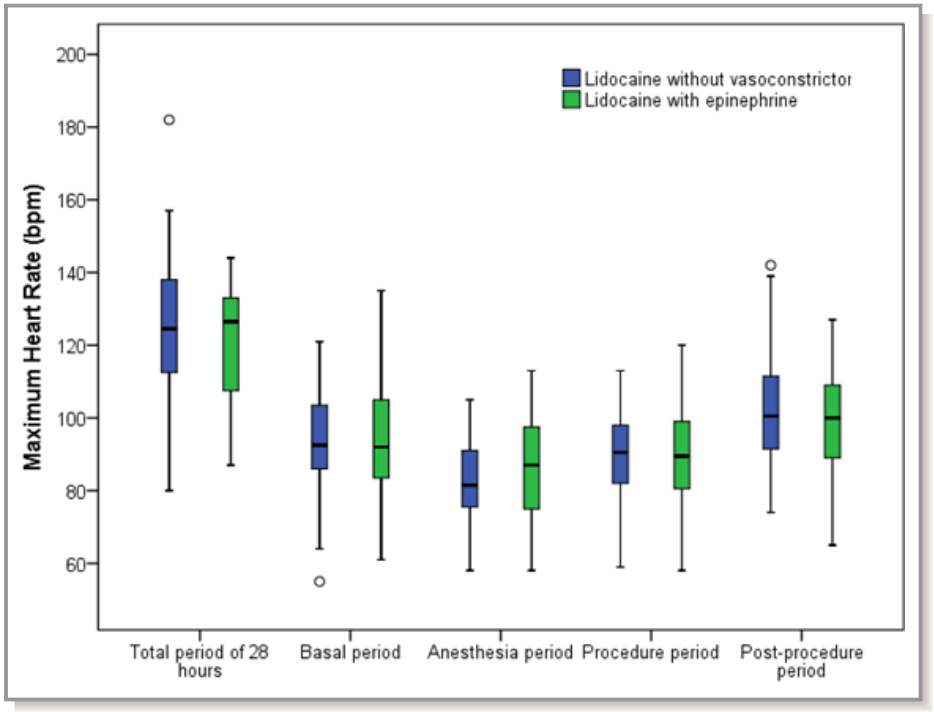

Figure 2. Mean values and respective SDs of maximum heart rate in each study period and comparison results. Bpm indicates beats per minute.

procedure. After 2 hours, the patient did not present abnormal electrocardiographic findings and was discharged the same day.

Karp and Ganoza[16] described the dental care of a 7-year-old boy with a medical history of LQTS using ICD. He experienced dental trauma after a syncope episode with

Table 7. Mean, SD, Median, Minimum, and Maximum QTc and Average QTc at 3 Study Moments in the Conditions Without A Vasoconstrictor and With Epinephrine in Patients With LQTS

Study moments	Without Vasoconstrictor	With Epinephrine	Difference Between the Pairs	*P* Value
Basal period				
QTc				0.487
Mean±SD	465.4±45.4	471.8±50.3	−6.38±35.77	
Median (minimum; maximum)	448 (408; 548)	456.5 (389; 592)	. . .	
End of anesthesia				
QTc				0.009
Mean±SD	450.1±41.8	465.4±42.9	−15.31±20.56	
Median (minimum; maximum)	445 (385; 549)	458 (390; 566)	. . .	
End of procedure				
QTc				0.208
Mean±SD	456.1±34.6	463.1±41.6	−7±21.27	
Median (minimum; maximum)	451 (410; 529)	447 (390; 557)	. . .	
Average QTc				0.109
Mean±SD	457.2±38.7	466.8±43.9	−9.56±22.45	
Median (minimum; maximum)	447 (402.7; 542)	457 (389.7; 571.7)	. . .	

LQTS indicates long-QT syndrome; QTc, corrected QT.
Paired Student's *t* test is related to *p* value numbers: 0.487; 0.009; 0.208; 0.109.

Table 8. Changes in the QTc Interval (Categorized in >10% of Shortening or Lengthening of QTc) After Administration of Local Anesthesia Comparing With Basal Period, Using Lidocaine Without A Vasoconstrictor and With Epinephrine in Patients With LQTS

Patient No.	Condition (Random)	LQTS Type	Changes in QTc Interval
2	Without epinephrine	2	No
	With vasoconstrictor		No
7	With vasoconstrictor	1	No
	Without epinephrine		No
12	Without epinephrine	2	No
	With vasoconstrictor		No
17	Without vasoconstrictor	2	No
	With epinephrine		No
19	Without vasoconstrictor	2	No
	With epinephrine		No
20	With epinephrine	1	No
	Without vasoconstrictor		No
21	With epinephrine	1	No
	Without vasoconstrictor		No
22	Without vasoconstrictor	1	No
	With epinephrine		No
23	With vasoconstrictor	2	Yes (shortening)
	Without epinephrine		No
24	Without epinephrine	Induced	No
	With vasoconstrictor		No
25	Without epinephrine	2	No
	With vasoconstrictor		No
26	With vasoconstrictor	2	No
	Without epinephrine		No
27	With epinephrine	1	No
	Without vasoconstrictor		No
29	With epinephrine	2	No
	Without vasoconstrictor		Yes (shortening)
30	Without epinephrine	3	No
	With vasoconstrictor		No
32	Without epinephrine	Induced	No
	With vasoconstrictor		No

LQTS indicates long-QT syndrome; QTc, corrected QT.

Table 9. Electrocardiographic Pattern in Patients with BrS at 3 Study Moments Using Lidocaine Without A Vasoconstrictor and With Epinephrine

Patient No.	Condition (Random)	Spontaneous BrS Type I Pattern	Changes in Electrocardiographic Pattern During the Study Moments
4	With epinephrine	Yes	No
	Without vasoconstrictor	Yes	No
8	Without vasoconstrictor	Yes	No
	With epinephrine	Yes	No
5	With epinephrine	No	No
	Without vasoconstrictor	No	No
6	Without vasoconstrictor	No	No
	With epinephrine	No	No
9	Without vasoconstrictor	No	No
	With epinephrine	No	No
10	With epinephrine	No	No
	Without vasoconstrictor	No	No
11	With epinephrine	No	No
	Without vasoconstrictor	No	No
13	With epinephrine	No	No
	Without vasoconstrictor	No	No
15	Without vasoconstrictor	No	No
	With epinephrine	No	No
31	With epinephrine	No	No
	Without vasoconstrictor	No	No
3	With epinephrine	No	Yes (at the end of anesthesia)
	Without vasoconstrictor	No	No
14	Without vasoconstrictor	No	Yes (at the end of anesthesia and end of procedure)
	With epinephrine	No	Yes (at the end of anesthesia and end of procedure)

BrS indicates Brugada syndrome.

development of torsade de pointes, and his tooth was extracted under general anesthesia without complications.

The findings of the present study are in agreement with the results published the past decade on the use of local anesthetics in cardiac patients. The investigations concluded that limited amounts of epinephrine (contained in 1 or 2 cartridges) did not result in the development of complications for patients with controlled cardiovascular disease, providing that the application of the anesthetic was adequate,[17] although the care of patients with CChs was not specifically addressed.

Although no life-threatening arrhythmias were triggered in our study, there was an increase of HR in all patients, as earlier reported by Blinder et al,[18,19] who evaluated patients with heart disease (coronary disease, valvopathy, hypertension, and atrial

Table 10. Mean, SD, Median, Minimum, and Maximum Values of Systolic and Diastolic BP at 3 Study Moments, Using Lidocaine Without A Vasoconstrictor and With Epinephrine

Study moments	Without Vasoconstrictor	With Epinephrine	*P* Value
Basal period			
Systolic BP			0.314*
Mean±SD	121.6±18	123.8±19.2	
Median (minimum; maximum)	117.5 (90; 150)	120 (95; 150)	
Diastolic BP			0.809*
Mean±SD	82±10.3	82±11.3	
Median (minimum; maximum)	80 (60; 100)	82.5 (65; 100)	
End of anesthesia			
Systolic BP			0.699*
Mean±SD	122.3±17.9	123±19.6	
Median (minimum; maximum)	120 (90; 150)	117.5 (95; 150)	
Diastolic BP			0.331*
Mean±SD	81.6±10	80.4±11.7	
Median (minimum; maximum)	80 (60; 100)	77.5 (65; 100)	
End of procedure			
Systolic BP			0.794*
Mean±SD	123.6±18.1	123.8±19.9	
Median (minimum; maximum)	120 (90; 150)	122.5 (95; 150)	
Diastolic BP			0.288*
Mean±SD	81.4±9.4	80±11.3	
Median (minimum; maximum)	80 (65; 100)	80 (65; 100)	

BP indicates blood pressure.
*Wilcoxon signed-rank test was used.

Table 11. Mean, SD, Median, Minimum, and Maximum of Anxiety Level at 3 Study Moments, Using Lidocaine Without A Vasoconstrictor and With Epinephrine

Anxiety Level	Without Vasoconstrictor	With Epinephrine	*P* Value
Basal period			0.564*
Mean±SD	1.29±0.6	1.36±0.56	
Median (minimum; maximum)	1 (1; 3)	1 (1; 3)	
Beginning of anesthesia			0.490*
Mean±SD	1.46±0.79	1.57±0.79	
Median (minimum; maximum)	1 (1; 3)	1 (1; 3)	
End of procedure			0.739*
Mean±SD	1.32±0.67	1.36±0.56	
Median (minimum; maximum)	1 (1; 3)	1 (1; 3)	

*Wilcoxon signed-rank test was used.

fibrillation) undergoing local anesthesia with 3 cartridges (5.4 mL) of 2% lidocaine with 1:100 000 epinephrine and 3% mepivacaine without a vasoconstrictor. All electrocardiographic changes occurred within 2 hours of local anesthetic injection. Holter analysis demonstrated that the most frequent complication after administration of the local anesthetic with a vasoconstrictor was tachycardia or increased HR, which was observed in 53.3% of patients compared with 7.1% of patients who received the local anesthetic without a vasoconstrictor.

However, Caceres et al[20] observed no changes in the number or complexity of ventricular premature beats, BP, and HR during the dental treatment of 65 patients with complex ventricular arrhythmia (33 patients with Chagas disease and 32 patients with coronary artery disease), despite the use of 2 to 4 cartridges of 3% prilocaine with 0.03 IU/mL felypressin and 2% lidocaine without a vasoconstrictor.

It is important to highlight the early identification of warning signs that can be evaluated at the dental office through the acquisition of a complete medical history as a means of preventing cardiac events in patients with LQTS. As a general recommendation, patients with a personal or family history of syncope should be referred to a cardiologist for the evaluation before any dental intervention. However, patients who present a syncope event in the dental office should be referred to the hospital emergency department.[21]

Although a genetically determined repolarization abnormality may be important at the onset of fatal arrhythmias, the sympathovagal imbalance could be a modulating factor in CChs.[22] Therefore, monitoring the HR in this study allowed the dynamic pattern observation of autonomic activity generated by sympathetic and parasympathetic activation and/or inhibition to be evaluated.[23] Even if subjective, anxiety assessment was performed during the dental procedure in an effort to relate the possible influence of stress on vital parameters.[24,25] The analysis of BP variations aimed to quantify the risk caused by use of vasoconstrictors adds to the stress of the dental procedure.[26,27]

Anxiety did not change significantly when the conditions with and without epinephrine were compared. We could

Table 12. Correlation Between the Anxiety Level and Systolic and Diastolic BP at 3 Study Moments, Using Lidocaine Without A Vasoconstrictor and With Epinephrine

Session	Variable		Correlation	N	*P* Value
Without vasoconstrictor	Basal period anxiety level	Systolic BP	0.292	28	0.131
		Diastolic BP	0.274	28	0.158
	Anesthesia period anxiety level	Systolic BP	0.104	28	0.599
		Diastolic BP	0.091	28	0.644
	End of procedure anxiety level	Systolic BP	0.124	28	0.530
		Diastolic BP	0.286	28	0.140
With epinephrine	Basal period anxiety level	Systolic BP	−0.006	28	0.975
		Diastolic BP	−0.044	28	0.823
	Anesthesia period anxiety level	Systolic BP	0.003	28	0.986
		Diastolic BP	0.070	28	0.723
	End of procedure anxiety level	Systolic BP	−0.064	28	0.746
		Diastolic BP	−0.052	28	0.793

Spearman correlation was used. BP indicates blood pressure.

Table 13. Anxiety Scores According to Order of Procedures and Results of Comparative Tests

Anxiety Level	First Session	Second Session	*P* Value
Basal period			0.564
Mean±SD	1.36±0.62	1.29±0.53	
Median (minimum; maximum)	1 (1; 3)	1 (1; 3)	
Beginning of anesthesia			0.038
Mean±SD	1.68±0.86	1.4±0.7	
Median (minimum; maximum)	1 (1; 3)	1 (1; 3)	
End of procedure			0.096
Mean±SD	1.4±0.6	1.3±0.6	
Median (minimum; maximum)	1 (1; 3)	1 (1; 3)	

Wilcoxon signed-rank test was used.

observe that in the first session of the treatment there was an increase in anxiety measure. When anxiety was compared with BP, there was no significant correlation.

Patients with these CChs are generally young and require dental treatment. Our study is most likely the first prospective and controlled minitrial that demonstrated safety of routine dental care in patients with CChs.

Limitations

The statistically significant proof of our hypothesis requires a multicenter trial with a sizable sample size of patients with CChs who received dental anesthesia with a vasoconstrictor. We excluded patients with recent (<3-month) life-threatening events (ventricular fibrillation, ventricular tachycardia, or appropriate device therapies), for safety and ethical considerations. Our analysis included only patients with LQTS or BrS because other types of CChs (eg, catecholaminergic polymorphic ventricular tachycardia) were also less prevalent. It is also important to emphasize that our findings are only applicable to clinically stable or treated patients with CChs with no recent events, as pointed out in our methods.

Conclusions

The use of local dental anesthesia with lidocaine, regardless of the use of a vasoconstrictor, did not result in life-threatening arrhythmias and could be considered safe in selected stable patients with CChs (LQTS and BrS). These preliminary findings need to be confirmed on a larger patient population.

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Disclosures

None.

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