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LOCAL ANESTHETICS IN PATIENTS WITH CARDIOVASCULAR DISEASES.

Hristo Daskalov, Atanaska Dinkova, Martin Drangov
Department of Oral Surgery , Faculty of Dental Medicine, Medical University - Plovdiv, Bulgaria

SUMMARY

A significant problem in the dental medicine is pain alleviation. Many studies in the dental anesthesiology result in the production of new agents for locoregional anesthesia. **Objective:** This article aim to present the results of the last studies on the effect of the local anesthetics used in the oral surgery on patients with cardiovascular diseases. **Material:** A general review of the existing literature on the effect of the adrenaline, included as vasoconstrictor in the local anesthetics, used in patients with cardiovascular diseases is made. The benefits of vasoconstrictors for the quality of the anesthetic effect are proven. **Conclusion:** A small amount of adrenaline in the anesthetic solution does not result in complications development in patients with controlled cardiovascular diseases. Articaine is recommended agent of first choice for local anesthesia in the oral surgery.

Key words: locoregional anesthesia, adrenaline, cardiovascular diseases, Articaine

INTRODUCTION

Pain management has long been an important problem in medicine. It becomes particularly important when the role of pain alleviation for the favorable outcome of the healing process is discussed. Pain management in dental medicine where most of procedures are painful is of superior importance. Number of studies in the field of dental anesthesia resulted in the development of new agents for locoregional anesthesia and new methods for pain management.

OBJECTIVE:

The aim of this article is to present the results of the last studies on the effect of the local anesthetics used in the oral surgery on patients with cardiovascular diseases.

MATERIAL:

In the last decade there are a growing number of studies of the use of anesthetics containing vasoconstrictors for patients with cardiovascular diseases. In great number of contemporary anesthetics vasoconstrictors are added for improvement of anesthetic effect. There is widespread allegation that in patients with cardiovascular diseases, the anesthetics should not contain vasoconstrictors. Many authors studied the influence of adrenaline on the cardiovascular system. The major part of the studies is on patients with cardiovascular diseases.

Migliau [1] defines the main factors having effect on patients' heart during oral-surgery treatment. They include the psychological stress, the anesthesia and the momentary medical therapy. On the other hand, studying the complications in the oral surgery in patient over 65 years, Amado-Cuesta et al. [2] come to the conclusion, that in elderly patients the most often concomitant diseases are hypertension, cerebrovascular and cardiac diseases, as well as diabetes. There are number of studies aiming the development of protocols for dental treatment of patients with cardiovascular diseases [3, 4, 5].

Frabetti et al. [6] conducted a study with 14 patients whether the epinephrine in the local anesthetics carries cardiovascular risks. The systolic and the diastolic blood pressure were analyzed, as well as the average and the maximal heart rate. The comparison of the initial blood pressure and the one after the post-anesthetic period showed insignificant tendency towards increasing the systolic pressure and slightly more statistically significant increased diastolic blood pressure. The heart frequency increases only in small number of the patients, however, not more than 10 beats per minute. In general, the group of the studied patients showed a statistically decrease in the average and the maximal heart rate from the beginning to the end of the session. Thus, the dosages of epinephrine administered to these patients result in insignificant changes in the heart rate and blood pressure. The decrease of the heart rate at the end of the therapy underlines the important role of the autonomic nervous system in the modulation of the cardiovascular response during dental therapy.

Davenport R. et al. [7] studied nine patients with stable cardiovascular diseases, which were evaluated in statistical crossover study during periodontal surgery using 2% lidocaine with adrenaline 1:100 000 or lidocaine without vasoconstrictor. In the group, anesthetized with lidocaine with adrenaline, the levels of adrenaline increased from 198/54 pg/ml to 592/166 pg/ml 2 minutes after the injection. In the group, which were anesthetized with lidocaine, the levels of adrenaline increased from initial level of 115/34 pg/ml to 150 /34 pg/ml within 2 minutes after the injection. Regardless of the increased adrenaline level, there were no significant changes in the heart rate or the average arterial blood pressure. The lidocaine without vasoconstrictor did not provide satisfactory hemostasis or anesthesia during the periodontal surgery. The study registers fast increase of the adrenaline plasma levels as a result of oral local anesthesia for periodontal surgery. These increases however, could not provoke significant cardiovascular response in the group of

patients with stable cardiovascular diseases. This suggests that the effects on cardiovascular system of the anesthetics containing adrenaline are small and they safely can be used in patients with stable cardiovascular diseases.

Knoll-Koeler et al. [8] studied the effect of the different concentration of adrenaline. The objective of this study was to define to what extend the surgical stress and the adrenaline in the anesthetics affect the levels of the serum catecholamines, the level of the potassium ions and the change in the cardiac-hemodynamic parameters. Articaine Hydrochloride (4 ml, 4%) with two different concentrations of adrenaline was randomly used in patients for extraction of retained wisdom tooth. The results showed that the exogenously obtained adrenaline during the anesthesia increases the serum levels of the catecholamines. The increased level of the serum adrenaline did not correlate with the cardiac-hemodynamic changes during the study. The serum levels of the catecholamines changes related to adrenaline, while the level of the potassium ions remained unchanged.

Lipp M. et al. [9] offered an interesting method for testing the catecholamines plasma levels. He used tritium-marked epinephrine to establish the serum levels of the vasoconstrictor after local anesthesia in 20 male healthy patients. The used anesthetic was Articaine 4% with 20 μg epinephrine as vasoconstrictor. Of the whole quantity of the used epinephrine was considered that 1.2% (100 ìicroCi) is tritium-marked. A blood sample was followed through central venous catheter before and in equal intervals after administration of local anesthetic. Significant increase of the exogenous epinephrine was observed in 4 patients during the injection (up to 6937 pg/ml). The other 16 patients showed gradual increase of the applied epinephrine, which reached peak values on the seventh minute (631.5+/-41.4 pg/ml). The second increase occurred after the start of the dental procedure. The level of the average total epinephrine was always higher than the level of the administered epinephrine. Extrasystoles were observed in 2 of 4, and tachycardia in 3 of 4 patients with high plasma level of the applied epinephrine.

Daublaender M. et al. [10] studied the rate of complications resulting from local anesthesia. In the study were included 2731 patients who received dental anesthesia. Risk factors were evaluated with a questionnaire as well as the type and dose of the local anesthetic, type and duration of the therapy and complications resulting from the local anesthesia. In the medical history of 45.9% of the patients was revealed at least one risk factor as cardiovascular diseases and allergies were most common. The overall rate of complications was 4.5% and significantly higher in patients with risk factors (5.7%), compared to non-risk patients (3.5%). The most common complications (dizziness, tachycardia, overexcitement, nausea and tremor) were transitory and did not require specific treatment. Other complications (fainting, bronchospasm) were observed only in two cases (0, 07%). It was established that Articaine is used in 90% of the cases requiring dental anesthesia in Germany, although there is a great variety of different types of anesthetics, and also, that Articaine with Epinefrine 1:100 000 causes more sympathomimetic effects compared with Articaine with Epinefrine 1:200 000.

Hirota Y. et al. [11] investigated the cardiac function of nine patients with various cardiovascular diseases by echocardiography during dental treatment. He compared the effect of Lidocaine with adrenaline and Prilocaine with Felypressin. Changes in the heart rate were observed only in one case.

Leviner E. et al. [12] studied the perioperative hemodynamic changes in 20 patients with stable Ischemic Heart Disease in functional class II-IV, subject to dental treatment. Calculus was removed in 7 patients without use of local anesthesia. 13 had reconstructions under local anesthesia of which 7 were treated with epinephrine containing anesthetic and in 6 without epinephrine containing anesthetic. During the dental procedure the heart rate, the blood pressure and the electrocardiography were constantly monitored. During the dental treatment in all patients was registered increased systolic blood pressure. In the group of patients treated without epinephrine containing anesthetic, the increase of the systolic pressure and the heart rate were significantly below the threshold of ischemia. Arrhythmia or ST segment depression of ≥1 mm was not registered in none of the patients.

Cintron G. et al. [13] conducted a study with 40 patients who underwent uncomplicated myocardial infarction, using Lidocaine with 1:100 000 adrenaline. He monitored the pulse, blood pressure and electrocardiography and did not register significant hemodynamic changes during the procedures.

In the literature has been discussed correspondence between the local anesthesia injection method and cardiovascular effects [14, 15]. There is number of studies trying to introduce new and different methods of local anesthesia [16, 17]. In 2005 Viana et al. [18] published a study in which they investigated the changes in the serum catecholamines levels after conventional mandibular block and Gow-Gates anesthesia method. The authors use Lidocaine with 1:100 000 epinephrine. In the study were included 18 patients divided in two groups (conventional mandibular anesthesia and Gow-Gates), as well a control group of nine people, where pure Mepivacaine was used. The blood pressure, pulse and the serum catecholamines levels were measured. The results were processed with variation analysis, which showed that the plasma levels of the adrenaline were statistically significantly higher in the group with conventional mandibular block, than in the patients with Gow-Gates anesthesia. At the same time, there was significant difference between the control group and the Gow-Gates group. The authors come to the conclusion, that the absorption of the exogenous adrenaline is influenced by the injection anesthesia method.

A number of studies try to establish the safety of the new anesthetics, as well as to make comparative analysis of the different types of anesthetics [19, 20, 21]. After its introduction in Germany in 1976, Articaine quickly became used worldwide. It is established that it is medicine of first choice for 90% of the doctors of dental medicine in Germany [10].

In 2000 Malamed et al. [22] made comparative analysis of Lidocaine and Articaine. They concluded that 4% Articaine is better tolerated by the patients and has better pain control. The beginning and the duration of the effect are comparable to the other most popular and studied anesthetics.

Anisimova et al. [23] conducted a large survey with 615 patients in which the effect of the local anesthetics with vasoconstrictors was studied. Patients were divided into six groups: using Lidocaine 2% without vasoconstrictor; Lidocaine 2% with adrenaline 1: 100 000; Mepivacaine 3% without vasoconstrictor; Mepivacaine 2% with adrenaline 1:100 000; Articaine with adrenaline 1:100 000 and Articaine 4% with adrenaline 1:200 000. After discussion of the results, the authors concluded that Articain 1:200 000 is the optimal anesthetic solution for most dental procedures. They recommend the adrenaline concentration of 1: 100 000 to be used as backup option for patients with very low threshold of sensitivity and where intentional ischemia of the tissues is wanted.

Neves et al. [24] studied the effect of adrenaline on patients with coronary diseases. In the study were included 62 patients aged from 39 to 80 years. In the first group was used lidocaine solution without vasoconstrictor; in the second group was used lidocaine with adrenaline 1:100 000. The blood pressure was analyzed with 24-hour record and dynamic electrocardiography. The comparison of the two groups did not show statistically significant difference in the blood pressure. The analysis of the 24-hour electrocardiography showed ST depression in 10 cases – six (20.7%) in the group received solution without adrenaline and four (14.8%) in the group received solution with adrenaline. No statistically significant difference was found between the groups (p=0.731). The analysis of the cardiac arrhythmias also did not show statistically significant difference between the two groups (p=1.00). The authors concluded that there was no difference in the change of the arterial pressure in two groups, related to the use of vasoconstrictor. Moreover there were no cases of cardiac arrhythmia or myocardial ischemia during the use of both types of anesthetic solutions.

In the search of anesthetics with optimal effect, studies are comparing not only the different types of anesthetics, but also the different types of vasoconstrictors [25]. In study of Sumer et al [26] was compared the pain from injection during administration of Articaine with adrenaline, Prilocaine with Felypressin, and Lidocaine with adrenaline. 497 patients anesthetized intraoraly with different solutions were included. The patients were evaluated subjectively and asked to rate their injection pain on a six-point scale. After analyzing the results, the authors concluded that there was no statistically significant difference between the pain felt during injection of three types of solutions. Referring to literature sources, according to which solutions with low pH are taken much more painfully, authors considered that the result is due to the similar pH of the solutions. Many authors emphasize the role of the injection method for more successful anesthesia of patients [27, 28], and other conduct research aiming at optimisation of the protocols for work with medically compromised patients [29, 30, 31].

CONCLUSION:

Based on the contemporary literature review, we can conclude that many studies aimed at improving the locoregional anesthesia of patients with cardiovascular diseases. The benefits from vasoconstrictors in anesthetic solutions for the quality of the anesthesia were being proven. Number of authors maintains the theory that a small amount of adrenaline in the anesthetic solution does not result in complications for patients with controlled cardiovascular diseases, while at the same time significantly increases the effect of the used anesthetic. Main subject of study is the anesthetic Articaine, as some authors recommend it as a first choice agent for local anesthesia in the oral surgery.

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Address of corresponding author:
Hristo Daskalov, DMD, DDS, PhD.
Oral Surgery Department, Faculty of Dental Medicine, Medical University, Plovdiv, Bulgaria
11, Opalchenska Str., 4000 Plovdiv, Bulgaria
Tel.: +359/888 58 92 42
E-mail: hdaskalov@hotmail.com,