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Research Article

Comparative Studies of Electrocardiographic Changes with Local Anesthesia in Oral Surgery with the Use of Holter Monitoring

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ABSTRACT

Introduction: Patients with heart diseaseoften do not get adequate surgical interventions because doctors fear the complications that may develop after the use of vasoconstrictors in local anesthetics. The purposeof the study is to determine the kind ofinfluence that Adrenalin has in the local anesthetic Unistesin in outpatient service of surgical patients that suffer from controlled forms of hypertension, coronary artery disease – angina and myocardial infarction, abnormalities of heart rhythm, through a 24 hour Holter monitoring of the cardiogram (before, during and after administering anesthesia), along with analyzing the values of the hemodynamic indicators.

Studydesign:The object of the study is a group of 60 people with heart diseases, selected by admission criteria, that have had an oral surgical intervention with the use of local anesthesia. They have been randomly divided into two groups: First group- 30 patients that have been given an anesthetic with corrigent (Ubistesin, 1: 200 000, 3M-ESPE), Second group- 30 patients that have been given an anesthetic without corrigent (UltracainD, Aventis). The ST segment and QT interval were observed. An analysis of the hemodynamic indicators was done.

Results: The results show a direct influence of the vasoconstrictors on the cardiac activity. The cardiogram showed no statistically significant difference in the changes of the studied markers (ST-segment and QT- interval), along with the main hemodynamic indicators (mean arterial pressure, pulse pressure, double product) in the patient groups that have used a different anesthetic(with and without corrigent). (P>0.05)

Conclusion:It can be concluded that the risk of using an anesthetic that contains 1:200 000 vasoconstrictors is minimal, while at the same time the quality of the anesthesia is sufficiently good so that the main stress component, that leads to the release of a large amount endogenous adrenalin, can be eliminated.

Keywords: local anesthetics, vasoconstrictors, Holter, cardiovascular diseases.

INTRODUCTION

Eliminating pain in patients with cardiovascular diseases in dental medicine is a serious challenge. It is well known that local anesthetics with vasoconstrictors have a negative effect on such patients. This is due to additional stress on the cardiovascular system that can lead to complications: brain or kidney complications,angina, arrhythmias, hypertensive crisis, etc[1,2].Furthermore, for the anesthesia to have an optimal effect the presence of a corrigent is required. A big factor for the development of such complications is the stress component that accompanies the surgical operation[3-5].The main method of analyzing cardiac function is through the use of an electrocardiograph. The results can be used to determine various deviations that could have been caused by different sources and diseases.By recording the electrocardiogram, we can determine changes in the time period of the electric potential, created from the heart during different stages of its activity. The main elements of the cardiogram are: P-waves, PQ-segments, PQ-intervals, QRS-complex, ST-complex and U-wave.The ST-interval depends on the metabolic processes in the myocardium and more specifically the oxygen procurement (hypoxia). This is why when there is deviation from the normal oxygen procurement changes in the ST-segment can be found. Examination of the ST-segment is a reliable marker that can eventually show cardiac ischemia or necrosis.When choosing a method some authorsprefer the use of a Holter monitor to register cardiovascular activity, due to the possibility of trackingthe changes in dynamic i.e. by analyzing changes in the cardiogram for long periods of time.

Opinions in literature about the use of anesthetics, that contain corrigents, are contradictive. The main position is that, in patients with heart disease, it is necessary to onlyuse clean anesthetics without vasoconstrictors.However, some authors agree with the standpoint that minimal corrigent quantity does not have an effect on individuals who suffer fromcardiovascular disease, while at the same time it drastically increases the quality of the anesthesia, that is being used, and the patient's comfort during dental treatment.The purposeof the study is to evaluate the influence of the corrigent Adrenalin in the local anesthetic Ubistesin in outpatient

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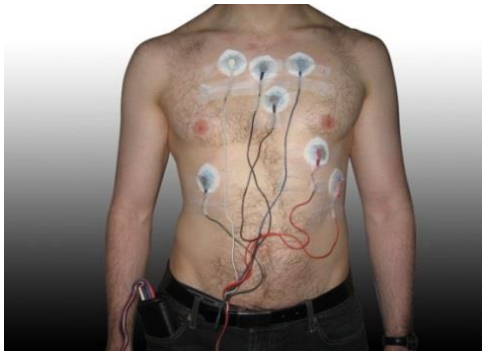

Figure 1: Patient withHolter

service of patientsthat have gone through surgery and suffer from compensated hypertension, ischemic heart disease, angina, rhythm and conduction disorders and myocardial infarction, through a 24 hour Holter monitoring of the cardiogram (before, during and after administering the anesthesia),as well as analyzing the values of the hemodynamic indicators.

Design of the study

The object of this study are 60 individuals with heart diseases that have undergone oral surgical operations under local anesthesia.A Holter recording of the cardiogram was done when each manipulation was carried out, along with registering the main hemodynamic indicators. Two groups were randomly created:

First group- 30 patientsthat have had an anesthetic with corrigent (Ubistesin, 1: 200 000, 3M-ESPE)

Second group- 30 patients that have had an anesthetic without corrigent (UltracainD, Aventis)

Admission criteria for the selection of patients

stable disease stage

possession of previous electrocardiogram

epicrisis of past hospital stay *(material that proves the disease stage)*

signed informed consent

All examined patients were given a Holter monitor in the morning of the day of the manipulation.(figure 1)

A HolterBMSElite(CenturySeries) byBiomedicalSystems-Germany was used.The resulting three-lead inspected respectively front, bottom and back wall of the heart.This way it is possible to determine an ischemic dynamic change to one of the heart walls. The Holter is equipped with a patient button with which the doctor can establish the moment of administering the anesthesia to the patient. With this anexact time can be

established which will help interpret possible changes that may occur in the electrocardiogram in heartbeat, ST-T changes, QT-interval. Subject to an occurred dynamic in the stated indicators were the first 3 hours after the dentist had administered the anesthesia – early effects (exudation of the anesthesia), along with the following hours until the end of the twenty fourth hourof the recording – late effects. During the manipulation three measurements of the main hemodynamic indicators have been done – pulse and blood pressure, respectively before, during and after the manipulation. Based on the results calculations of mean arterial pressure, pulse pressure, double productwas done. Right before administering the anesthesia the button is activated to mark the action onto the Holter monitor thus making the exact moment of administration known. The duration of the manipulation is also marked. The Holter is removed on the next morning, after which the information is processed bythe software - BMSCenturySeriesV.2.0. The main indicators that are monitored are the ST segment and the QT interval of the cardiogram. They aremarkedas a baseline before the manipulation and are analyzed after the anesthesia. The data is then inserted in a workcard, which shows an absence or presence of ST depression before and after administering the anesthesia.In the presence of a ST depression its length is measured to determine if it is 1mm or above. QT intervals were analyzed to determine if there was any prolonging before and after administering the anesthesia.The whole dynamic of the cardiac activity was monitored for the entire 24-hour duration of the study.Based on the data collected from the cardiogram elements and the hemodynamic indicators a conclusion was made of a possible myocardial ischemia caused by the administered anesthetic that contained a vasoconstrictor.Taking the effectiveness of the used anesthetic into account, subjective data from the patient to the absence or presence of pain during manipulation.Taking into consideration the purpose of the study, as well as the amount and the type of the gathered data, we used parametric and nonparametric statistical methods, and graphics to visualize the results.

RESULTS

The study results show the direct influence of the vasoconstrictors on the cardiac activity. 60 patients were studied (N=60), of which 30 (50%) men and 30 (50%) women. The average age is 62.17± 1.48. The average duration of the procedures is 24.90±1.98 minutes, as the shortest is 10 min, and the longest is 120 min. The distribution of diagnosis is: 27 (45%) patients have hypertensive heart disease, 18 (30%) suffer from stable anginas, 12 (20%) have rhythm and conduction disorders and 3(5%) have had myocardial infarction. In order to study the effect of the adrenaline, we have analyzed the major hemodynamic indexes in the two groups. The obtained results clearly show that there is no statistically significant difference in the mean arterial pressure compared for the two groups before, during and after the manipulation. In the group with used adrenaline, it is 95.73±2.79 before the manipulation, 98.94±2.02 during

Table 1: Change of the mean arterial pressure by group of anesthetic

Parameter	Group	N	mean±SE	t	P
Change of MAP	Adrenaline	30	103.88±3.51	1.14	>0.05
	No adrenaline	30	99.71±1.02		

Table 2: Distribution depending on the changes in the ST-segment (before and after manipulation) by groups of anesthetic

ST	No		Yes		Total		P
	N	%	N	%	N	%	
Anesthetic							
Adrenaline	28	93.3	2	6.7	30	100	>0.05
No adrenaline	27	90.0	3	10.0	30	100	
Total	55	91.7	5	8.3	60	100	

Table 3: Comparison of the dependence of the MAP and pulse rate with the changes in the ST-segment

Parameter	ST	N	mean±SE	t	P
MAP before manipulation	No	55	99.30±1.97	0.49	>0.05
	Yes	5	96.00±3.85		
MAP aftr manipulation	No	55	100.03±1.66	1.73	>0.05
	Yes	5	96.33±1.33		
Pulse before manipulation	No	55	72.04±1.58	0.80	>0.05
	Yes	5	76.40±4.53		
Pulse after manipulation	No	55	74.69±1.55	0.49	>0.05
	Yes	5	77.40±5.88		

the manipulation, and 97.44±1.92 after the manipulation. In the group without adrenaline it is 102.33±2.25before the manipulation, 102.94±2.31during the manipulation, and 102.00±2.35 after the manipulation. It was established, that there is no statistically significant difference in the change of the mean arterial pressure followed over time in the two groups with different anesthetics (t=1.14, P>0.05)(Tab.1).Similar analysis was done for the other studied hemodynamic indexes – double product and pulse pressure. The changes in the value of the pulse pressure are used as a sign for advancing significant cardiovascular events, and the double product indicates the oxygen consumption of the heart muscle. The comparison of the changes of these parameters in the two groups did not show statistically significant difference (P>0.05).To objectify the study and to eliminate possible confounding factors, we study whether there is correlation between the duration of the manipulation and the change of MAP. No such correlation was found. The correlation coefficient is significant at level of significance 0.05.The subjective sensations of the patients from the two groups are presented with the presence or absence of pain during the manipulation. The patients from the first group – 30 (100%) have reported complete lack of pain during the whole time of the treatment. The second group – 26 (86.7%) have confirmed lack of pain, and 4 (13.3%) have reported pain. No correlation dependence was found between the duration of the manipulation and the presence of pain during the treatment (t= 0.013, P= 0.989).During the 24-hour Holter monitoring performed during the procedure, we were looking for changes in the main indexes, signs of cardiovascular incident: ST-segments and QT-intervals. In the first group we found changes in the ST-segment in two cases (6.7%). In the other 28 (93.3%) no such changes were found. In the second group there were changes in 3 cases (10%), the other 27(90%) did not show changes of the measured segment. The registered ST-segment depression in all five cases was initial, i.e. it was present before the manipulation. The initial ST-segment depression is within 0.5 mm, as during the manipulation it increases to 1 mm, but it is rate-dependent, i.e. tachycardia dependent, which is not significant – faster ascending type. Generally, none of the patients showed significant ST-change of ischemic type during the manipulation. On the other hand, there were no rhythm and conduction disorders provoked by the manipulation. At the same time, there was no change in the length of the corrected QT-interval during the manipulation. Initially, all patients have normal QT-interval. No change in the QT-interval was registered in both groups (Table 2).There was no statistically significant difference in the changes of the ST-segment for the two groups with different anesthetic, respectively before ($\chi2$=0,218,df=1,P=0.640)and after ($\chi2$=0,218,df=1,P=0.640)the manipulation.Also, there was no statistically significant difference in the change of the mean arterial pressure and pulse rate in the two groups, which could be associated in any way with the changes in the ST-segment (P>0.05). In all patients there is acceleration of the pulse during the manipulation, which is largely provoked by the emotional stress of the manipulation itself, and the concomitant sympathectomy (Table 3).

DISCUSSION

The discussion of the results is done within the context of the cardiological aspect of the influence of the local anesthetics on patients with cardiovascular diseases during their dental, particularly surgical treatment. Our main hypothesis that small quantities of adrenaline contained in the modern anesthetics, does not have negative influence on the cardiovascular system, was proved by the absence of statistically significant difference in the changes of the cardiovascular activity in the two groups of patients. We did not register significant changes in the ST-segment and the QT-interval in the two groups of patients. Many other authors have reached similar conclusions. After similar study Vanderheyden[6]come to the conclusion that the use

of anesthetic containing vasoconstrictor in 1: 100 000dilutions, does not have particular risk for cardiovascular patients. Moreover, they report that to be significant the ST-segment depression has to be over 1 mm, which we did not find in our patients. We did not find statistically significant correlation in the change of the mean arterial pressure and the pulse rate in the two groups, which could be in any way associated with the changes in the ST-segment (P>0,05). In addition to the dynamic electrocardiography, our hypothesis is confirmed also by the studied hemodynamic indicators. We did not find statistically significant difference in the changes before and after the anesthesia in the MAP, the pulse pressure and the double product, compared with the two groups of patients. Other authors also focus on the hemodynamic problems during anesthesia, which means that they provide valuable information on the possible complications[7-10].Main corrective of our work is the subjective opinion of the patient on the quality of the provided treatment, which in most cases is associated with the lack or presence of pain. We established that none of the patients in the group using anesthetic with coregent reports pain, while the other group, 13.30% of the patient report unpleasant sensations. We attribute this to the weaker effect of the pure local anesthetics. Here, we could discuss the reduction of the endogenous adrenaline, as a result of the better anesthesia.

CONCLUSION

We did not find statistically significant difference in the changes of the studied markers of the cardiogram (ST-segments and QT-interval), or of the main hemodynamic indicators (mean arterial pressure, pulse pressure and double product) in the group of patients using different anesthetic (with and without coregent) in the two group of patients (P>0.05). Based on the conducted study, we may come to the conclusion, that the risk from the use of anesthetic with vasoconstrictor in 1:200 000 dilutions is minimal, while at the same time, the quality of the anesthesia is sufficient to eliminate the main stress component, leading to the discharge of large amount of endogenous adrenaline.

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