



HEMODYNAMIC FUNCTION IN COMPARISON OF TWO TYPES OF LOCAL ANESTHESIA WITH VASOCONSTRICTOR IN DAY SURGERY: RETROSPECTIVE STUDY

Tomica Bagatin^{1,2}, Marin Škrtić³, Livija Šakić^{2,3,4},
Dinko Bagatin^{1,2}, Kata Šakić^{1,2,3}, Judith Deutsch¹ and Ivan Šklebar^{3,4}

¹Polyclinic Bagatin for maxillofacial, general and plastic surgery and anesthesiology, Zagreb,
²Faculty of Dental Medicine and Health Osijek, Josip Juraj Strossmayer University of Osijek, Croatia
³Croatian Catholic University, Zagreb
⁴University Hospital Sveti Duh Zagreb

Abstract - Hemodynamic changes and cardiac arrhythmias are not uncommon in clinical practice, depending on including patient features, surgical treatment and drugs administered. We describe hemodynamic changes developed in young patients, soon after a local infiltration anesthesia in day surgery.

Methods - We retrospectively assessed the hemodynamic effect of 2% lidocaine with 0,0125mg/ml adrenaline (Li & AD) administered for septorhinoplasty in 44 participants and combination of 0.5% bupivacaine and 2% lidocaine with 0.0125mg/ml adrenaline (BLi & AD) for breast augmentation in 48 participants. Blood pressure and heart rate were recorded before the introduction of general anesthesia, immediately 5, 10 and 20 minutes after administration of local infiltration, anesthetic (LIA) and data were analyzed.

Results - The mean systolic blood pressure (SBP) in all observed measurements before general anesthesia (0), immediately, 5 minutes, 10 minutes and 20 minutes after local infiltration anesthesia was higher among patients who underwent septorhinoplasty (Li & AD), in relation to patients who underwent breast augmentation (BLi & AD) ($p < 0.05$). The level of diastolic blood pressure (DBP) in measurement 20 minutes compared to measurement in 10 minutes was increased by 9,52 mmHg. The septorhinoplasty group showed a significant increase in heart rate measured 20 minutes after local infiltration anesthesia with adrenaline.

Conclusions - Measured transitory changes in heart rate and blood pressure after local infiltration of vasoconstrictor anesthetics in healthy patients prior to septorhinoplasty and breast augmentation may be induced by endogenous and / or exogenous epinephrine. Bupivacaine solution for local infiltration analgesia reduces hemodynamic disturbances and prolongs analgesic effect. We highlight the need for careful preoperative evaluation, including anxiety assessment and treatment in all patients in day surgery.

Keywords: *local infiltration anesthesia, cardiovascular changes, septorhinoplasty, breast augmentation*

Introduction

Cardiovascular disease being one of the major causes of morbidity and mortality is also increasing

in day surgery. Hemodynamic changes and cardiac arrhythmias are not uncommon in clinical practice, depending on including patient features, surgical treatment and drugs administered (1, 2). Management in the day surgery clinic is challenging because of fluctuating blood pressures and heart rates, and an attentive approach is required to avoid complications during day plastic surgical treatment (3,4,5,6,7). Local infiltration anesthesia (LIA) with local anesthetic

Corresponding author: *Full Prof. Kata Šakić, MD PhD, tenured*
Croatian Catholic University, Zagreb
10000 Zagreb, Croatia
0038598318317; E-mail: kata.sakic@unicath.hr
<https://orcid.org/0000-0001-5413-6382>

solutions contains vasoconstrictors that are commonly used and may potentially affect the cardiovascular condition (8). Lidocaine with adrenaline, which is one of the most frequently used anesthetics during LIA treatment, is known to affect vasoconstriction, cardiac contractility, and heart rate by increasing catecholamine levels (9).

A case of isolated atrial fibrillation reported after administration of dental local anesthesia (1). The safety records of local anesthetics and their vasoconstrictors have been impressive and will remain so with the continued reasonable use of these agents. We describe hemodynamic changes developed in young healthy patients, soon after a local infiltration anesthesia in day plastic surgery.

Methods

We selected 92 young healthy adults, aged 24-38 years, requiring aesthetic day surgery under general anesthesia. We compared hemodynamic effect of two types local infiltration anesthesia with vasoconstrictor indicated before septorhinoplasty and breast augmentation in Polyclinic Bagatin, Zagreb, in the period from 1st October 2021, to 31st March 2022.

Exclusion criteria were as follows: systolic blood pressure (SBP) >140 mm Hg, diastolic blood pressure (DBP) >90 mm Hg, severe liver disease, severe kidney

disease, uncontrolled cardiac arrhythmia, dementia and significant acute pain. This study was conducted under the approval of the Polyclinic Bagatin Ethics Review Board. Informed consent was obtained from all participants.

A blood pressure monitor, electrocardiography monitor, and pulse oximeter during general anesthesia in the supine position were used to record blood pressure, pulse rate, and oxygen saturation.

We retrospectively assessed the hemodynamic effect of 2% lidocaine with 0.0125mg/ml adrenaline (Li & AD) administered for septorhinoplasty in 44 participants and in combination of 0.5% bupivacaine and 2% lidocaine with 0.0125mg/ml adrenaline (BLi & AD) for breast augmentation in 48 participants. Blood pressure (BP) and heart rate (HR) were recorded before induced of general anesthesia, immediately 5, 10 and 20 minutes after administration of local infiltration anesthetic (LIA). This study analyzed the data at 4 points. Local anesthesia was performed by a surgeon with clinical experience of more than 10 years.

Septorhinoplasty

The total amount of anesthetic agent used in all cases was 4-8ml 2% lidocaine with adrenaline for septorhinoplasty (Figure 1 A, B)

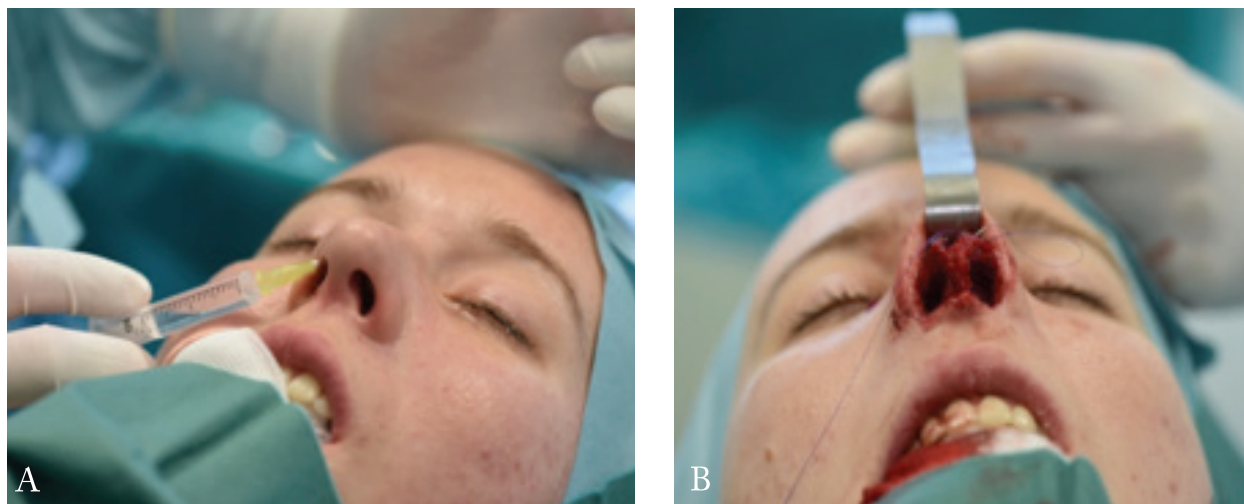


Figure 1 Local infiltration anesthesia (A) for septorhinoplasty (B)

Breast augmentation

The total amount of anesthetic agent used in all cases was 4mL 2% lidocaine with adrenaline (0.0125) mg/ml and 5ml 0.5% bupivacaine for one side of breast augmentation (Figure 2 A,B).

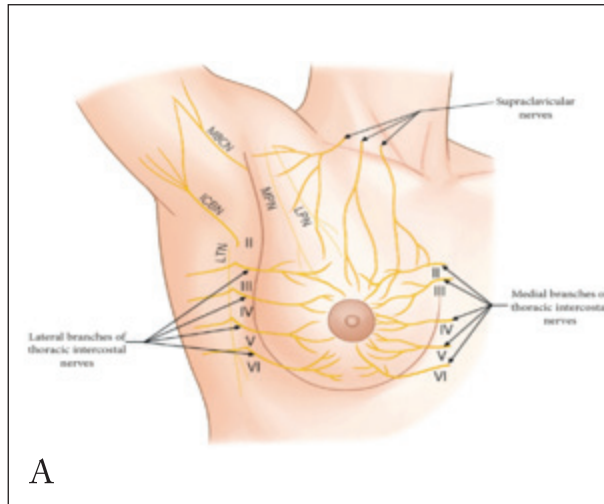


Figure 2 Innervation of the breast (A) Local infiltration of the wound in the operating room (B)

We analyzed the numerical rating scale (NRS) to evaluate the postoperative acute pain of participants required for analgesic treatment. NRS was measured three times: just after the wakening participants from general anesthesia (0) entered the recovery room and one hour and three hours after surgery and injection of the local anesthetics.

Statistics. The paper uses tabular presentation methods that show the structure of patients according to the observed characteristics, while numerical values are presented using descriptive statistics methods. Examination of differences between numerical values is tested by the T-test for independent measurements, and in the case of multiple measurements, the T-test for repeated measurements is used.

Differences in representation are examined by the Z test of differences in the proportions of independent sets. The analysis was performed in the statistical software Statistica 12.

Results with descriptive levels (p values) lower than .05 were considered statistically significant.

Results

For the purposes of this research, secondary data sources were accessed at the Polyclinic Bagatin Zagreb, and data on the trends of cardiovascular parameters in patients who underwent septorhinoplasty and breast augmentation in day surgery were collected.

Among the observed patients, 44 patients (47.83%) underwent septorhinoplasty, and 48 (52.17%) underwent breast augmentation.

The mean age of patients who underwent septorhinoplasty is 28.5 years (IQR=24-38), while the mean age of patients who underwent breast augmentation is 31.5 years (IQR=26-38). No statistically significant difference has been found ($t=1.37$; $P=0.173$).

There were more female patients in the septorhinoplasty group, while the patients who underwent breast augmentation were exclusively female. The study found a statistically significant difference in the representation of female patients with regard to the type of surgery ($\chi^2=10.88$; $P<0.001$).

Blood pressure and heart rate were measured and recorded before induction of general anesthesia (0), immediately, 5 minutes, and 10 minutes and 20 minutes after local infiltration, an aesthetic (LIA) administration, and the data were analyzed.

The mean value of systolic blood pressure (SBP) in all observed measurements was higher among patients who underwent septorhinoplasty compared to patients who underwent breast augmentation. The study revealed the presence of a statistically significant difference ($P<0.050$).

Table 1 Measured systolic blood pressures (SBP) before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of bupivacaine in breast augmentation and lidocaine in septorhinoplasty

SBP	All			Breast augmentation			Septorhinoplasty			t	P*
	N	Mean	SD	N	Mean	SD	N	Mean	SD		
0	92	114.68	12.28	48	111.54	10.32	44	118.11	13.41	2.65	0.010
5	92	104.66	15.76	48	100.79	14.86	44	108.89	15.79	2.53	0.013
10	92	90.64	9.43	48	87.92	6.59	44	93.61	11.11	3.02	0.003
20	92	93.48	8.73	48	90.63	5.42	44	96.59	10.50	3.47	0.001

(P<0.050).

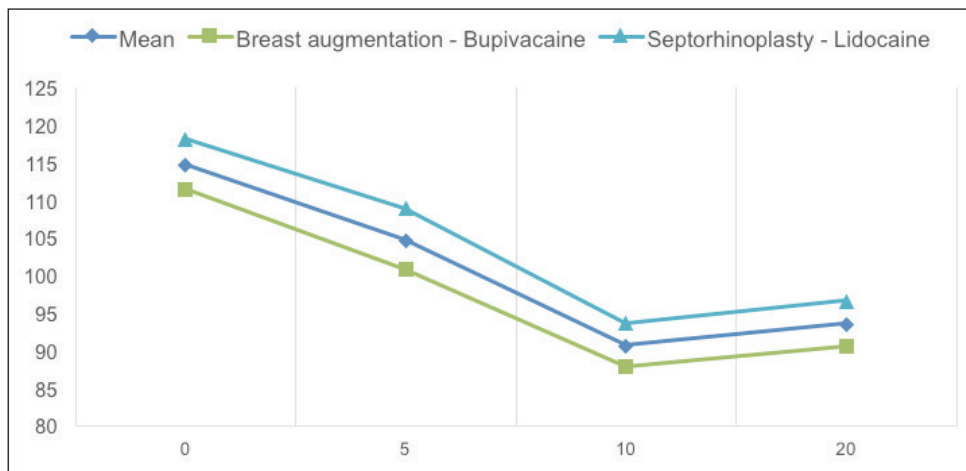


Figure 3 Measured systolic blood pressures (SBP) before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of Bupivacaine in breast augmentation and Lidocaine in septorhinoplasty

Table 2 Measured systolic blood pressures before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of Lidocaine (Li&AD) in septorhinoplasty

SBP measurement	Surgery=septorhinoplasty, SBP T-test					
	Mean	SD	N	Difference	t	p
0	118.11	13.41				
5	108.89	15.79	44	9.23	4.34	<0.001
0	118.11	13.41				
10	93.61	11.11	44	24.50	12.38	<0.001
0	118.11	13.41				
20	96.59	10.50	44	21.52	10.90	<0.001
5	108.89	15.79				
10	93.61	11.11	44	15.27	6.99	<0.001
5	108.89	15.79				
20	96.59	10.50	44	12.30	5.01	<0.001
10	93.61	11.11				
20	96.59	10.50	44	-2.98	1.40	0.169

Among patients who underwent septorhinoplasty, the SBP value decreased by 9.23 in measure 5 compared to measure 0, and the presence of a statistically significant difference was found ($t=4.34$; $P<0.001$). Measurement 10 showed a 24.50 lower value compared to measurement 0, and the presence of a statistically significant difference was found ($t=12.28$; $P<0.001$). In measurement 20, compared to measurement 0, a lower value of 21.52 was recorded, and the presence of a

statistically significant difference was found ($t=10.90$; $P<0.001$).

Compared to measurement 5, in measurement 10 a lower value of 15.27 was recorded ($t=15.27$; $P<0.001$), as well as in measurement 20 when a lower value of 12.30 was recorded ($t=5.01$; $P<0.001$).

No statistically significant difference between measurement 10 and measurement 20 was found ($t=1.40$; $P=0.169$).

Table 3 Measured systolic blood pressures before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of Bupivacaine (BLi&AD) in breast augmentation

Measurement	Surgery=breast augmentation, SBP					
	Mean	SD	N	Difference	t	p
0	111.54	10.32				
5	100.79	14.86	48	10.75	6.01	<0.001
0	111.54	10.32				
10	87.92	6.59	48	23.63	14.38	<0.001
0	111.54	10.32				
20	90.63	5.42	48	20.92	13.20	<0.001
5	100.79	14.86				
10	87.92	6.59	48	12.88	5.49	<0.001
5	100.79	14.86				
20	90.63	5.42	48	10.17	4.45	<0.001
10	87.92	6.59				
20	90.63	5.42	48	-2.71	2.48	0.017

Among patients who underwent breast augmentation, the SBP value decreased by 10.75 in measure 5, compared to measure 0, and the presence of a statistically significant difference was found ($t=6.01$; $P<0.001$). Measurement 10 showed a 23.63 lower value compared to measurement 0, and the presence of a statistically significant difference was found ($t=14.38$; $P<0.001$). In measurement 20 compared to measurement 0, a lower value of 20.92 was recorded, and the presence of a statistically

significant difference was found ($t=13.20$; $P<0.001$).

Compared to measurement 5, in measurement 10 a lower value of 12.88 was recorded ($t=5.49$; $P<0.001$), as well as in measurement 20 when a lower value of 10.17 was recorded ($t=5.45$; $P<0.001$).

The value of SBP in measurement 20 compared to measurement 10 increased by 2.71, and the presence of a statistically significant difference was found ($t=2.48$; $P=0.017$).

Table 4 Measured arterial diastolic pressures (DBP) before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of bupivacaine (BLi&AD) in breast augmentation and lidocaine (Li&AD) in septorhinoplasty

DBP	All			Breast augmentation			Septorhinoplasty			t	P*
	N	Mean	SD	N	Mean	SD	N	Mean	SD		
0	92	65.76	8.34	48	64.52	8.21	44	67.11	8.37	1.50	0.137
5	92	61.23	10.98	48	58.96	11.53	44	63.70	9.90	2.11	0.038
10	92	51.50	7.95	48	49.58	6.59	44	53.59	8.82	2.48	0.015
20	92	60.13	9.71	48	57.40	7.99	44	63.11	10.60	2.94	0.004

The mean value of DBP in the first measurement did not differ statistically significantly among patients who underwent breast augmentation and septorhinoplasty ($P=0.137$), while in the repeated measurements a

higher value was found among patients who underwent septorhinoplasty compared to patients who underwent breast augmentation. The presence of a statistically significant difference was found ($P<0.050$). (Figure 4)

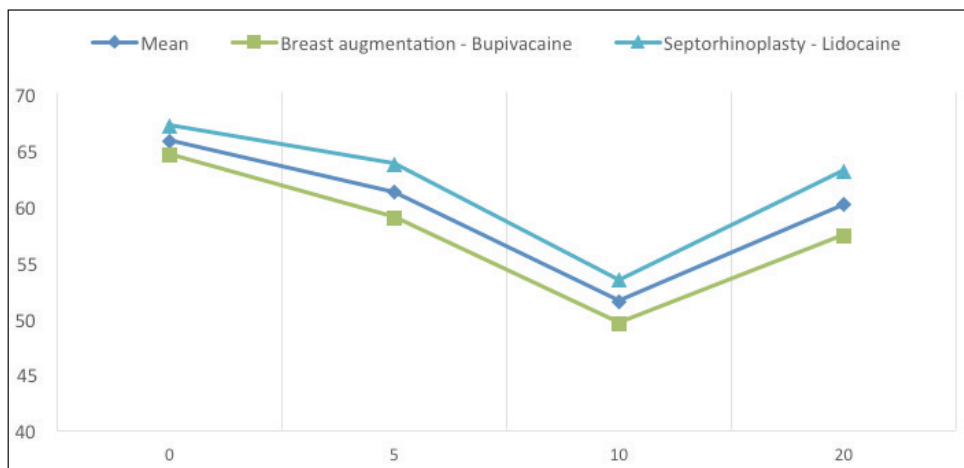


Figure 4 Measured diastolic blood pressures (DBP) before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of Bupivacaine in breast augmentation and Lidocaine in septorhinoplasty

Table 5 Measured diastolic blood pressures (DBP) before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of Lidocaine&AD in septorhinoplasty

DBP measurement	Surgery=septorhinoplasty, DBP					
	Mean	SD	N	Difference	t	P
0	67.11	8.37				
5	63.70	9.90	44	3.41	2.25	0.029
0	67.11	8.37				
10	53.59	8.82	44	13.52	8.91	<0.001
0	67.11	8.37				
20	63.11	10.60	44	4.00	2.38	0.022
5	63.70	9.90				
10	53.59	8.82	44	10.11	5.24	<0.001
5	63.70	9.90				
20	63.11	10.60	44	0.59	0.28	0.778
10	53.59	8.82				
20	63.11	10.60	44	-9.52	5.85	<0.001

Among patients who underwent septorhinoplasty, the DBP value decreased by 3.41 in measurement 5 compared to measurement 0, and the presence of a statistically significant difference was found ($t=2.25$; $P=0.029$). Measurement 10 found a 13.52 lower value compared to measurement 0, and the presence of

a statistically significant difference was found ($t=8.91$; $P<0.001$). In measurement 20 compared to measurement 0, a lower value of 4.00 was recorded, and the presence of a statistically significant difference was found ($t=2.38$; $P=0.022$).

Compared to measurement 5, measurement 10

found a 10,11 lower value ($t=5.24$; $P<0.001$), while measurement 20 found only a 0.59 lower value, and no statistically significant difference was found ($t=0.28$; $P=0.778$).

The level of DBP in measurement 20 compared to measurement 10 was increased by 9.52, and the presence of a statistically significant difference was found ($t=5.85$; $P<0.001$).

Table 6 Measured diastolic blood pressures (DBP) before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of Bupivacaine (BLi&AD) in breast augmentation

SBP measurement	Surgery=breast augmentation, DBP					
	Mean	SD	N	Difference	t	p
0	64.52	8.21				
5	58.96	11.53	48	5.56	3.25	0.002
0	64.52	8.21				
10	49.58	6.59	48	14.94	10.25	<0.000
0	64.52	8.21				
20	57.40	7.99	48	7.13	4.03	<0.000
5	58.96	11.53				
10	49.58	6.59	48	9.38	4.92	<0.000
5	58.96	11.53				
20	57.40	7.99	48	1.56	0.83	0.413
10	49.58	6.59				
20	57.40	7.99	48	-7.81	5.50	<0.000

Among patients who underwent breast augmentation, the DBP value decreased by 5.56 in measure 5 compared to measure 0, and the presence of a statistically significant difference was found ($t=3.25$; $P=0.002$). Measurement 10 found a 14.94 lower value compared to measurement 0, and the presence of a statistically significant difference was found ($t=10.25$; $P<0.001$). In measurement 20 compared to measurement 0, a lower value of 7.13 was recorded, and the presence of a statistically significant difference was found ($t=4.92$; $P<0.001$).

Compared to measurement 5, measurement 10 found a 9.38 lower value ($t=4.92$; $P<0.001$), while measurement 20 found only a 1.56 lower value, and no statistically significant difference was found ($t=0.83$; $P=0.413$).

The level of DBP in measurement 20 compared to measurement 10 was increased by 9.52, and the presence of a statistically significant difference was found ($t=5.85$; $P<0.001$).

The mean value of HR did not differ statistically significantly among patients who underwent

Table 7 Measured heart rate (HR) before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of Bupivacaine (BLi&AD) in breast augmentation and Lidocaine (Li&AD) in septorhinoplasty

HR/ bpm	All			Breast augmentation			Septorhinoplasty			t	P*
	N	Mean	SD	N	Mean	SD	N	Mean	SD		
0	92	73.23	11.87	48	72.75	11.42	44	73.75	12.45	0.40	0.689
5	92	73.28	11.09	48	71.46	9.11	44	75.27	12.71	1.66	0.099
10	92	75.09	9.59	48	75.17	9.18	44	75.00	10.12	-0.08	0.934
20	92	80.98	11.96	48	81.77	11.18	44	80.11	12.83	-0.66	0.510

breast augmentation compared to patients who underwent septorhinoplasty in the first measurement,

nor in repeated measurements ($P>0.050$). Figure 5

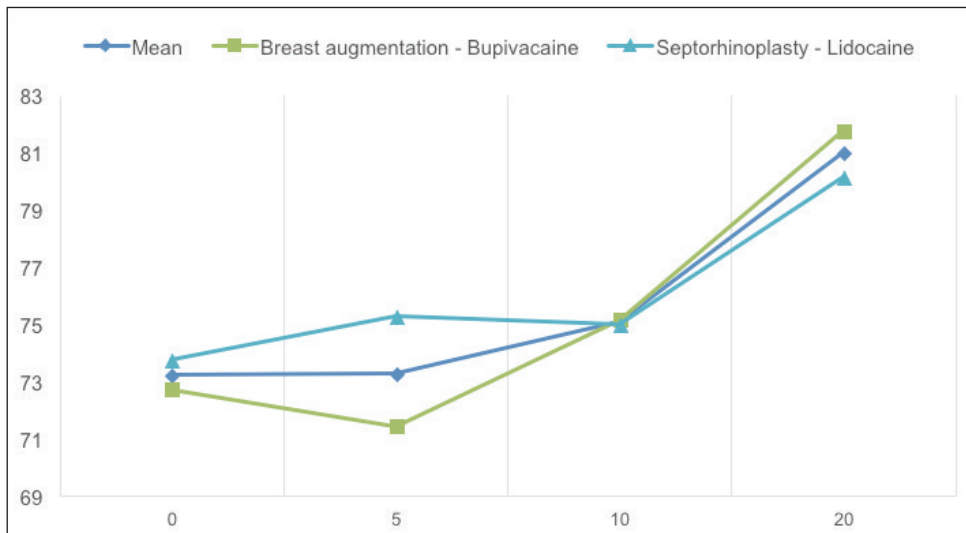


Figure 5 Measured heart rate (HR) before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of Bupivacaine in breast augmentation and Lidocaine in septorhinoplasty

Table 8 Measured heart rate (HR) before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of Lidocaine in septorhinoplasty

HR measurement	Surgery=septorhinoplasty, HR					
	Mean	SD	N	Difference	t	p
0	73.75	12.45				
5	75.27	12.71	44	-1.52	1.06	0.296
0	73.75	12.45				
10	75.00	10.12	44	-1.25	0.65	0.516
0	73.75	12.45				
20	80.11	12.83	44	-6.36	3.17	0.003
5	75.27	12.71				
10	75.00	10.12	44	0.27	0.16	0.873
5	75.27	12.71				
20	80.11	12.83	44	-4.84	2.66	0.011
10	75.00	10.12				
20	80.11	12.83	44	-5.11	3.33	0.002

Among patients who underwent septorhinoplasty, an increase in HR values of 1.52 was found in measure 5 compared to measure 0, while the presence of a statistically significant difference was not found ($t=1.06$; $P=0.296$). Measurement 10 showed a 125 higher value compared to measurement 0, while no statistically significant difference was found ($t=0.65$; $P=0.516$). In

measurement 20 compared to measurement 0, a higher value of 6.36 was recorded, and the presence of a statistically significant difference was found ($t=3.17$; $P=0.003$).

Compared to measurement 5, measurement 10 found a 0.25 lower value ($t=0.16$; $P=0.873$), while measurement 20 determined a 4.84 higher value,

and the presence of a statistically significant difference was found ($t=2.66$; $P=0.011$).

The value of HR in measurement 20 compared to

measurement 10 was increased by 5.11, and the presence of a statistically significant difference was found ($t=3.33$; $P=0.002$).

Table 9 Measured heart rate (HR) before induction of general anesthesia and 5, 10 and 20 minutes after local infiltration of Bupivacaine in breast augmentation

HR measurement	Surgery=breast augmentation, HR					
	Mean	SD	N	Difference	t	p
0	72.75	11.42				
5	71.46	9.11	48	1.29	0.97	0.339
0	72.75	11.42				
10	75.17	9.18	48	-2.42	1.47	0.148
0	72.75	11.42				
20	81.77	11.18	48	-9.02	3.97	<0.001
5	71.46	9.11				
10	75.17	9.18	48	-3.71	2.44	0.018
5	71.46	9.11				
20	81.77	11.18	48	-10.31	5.23	<0.001
10	75.17	9.18				
20	81.77	11.18	48	-6.60	3.74	<0.001

Among patients who underwent breast augmentation, the HR value decreased by 1.29 in measurement 5 compared to measurement 0, while no statistically significant difference was found ($t=0.97$; $P=0.339$). Measurement 10 showed a 2.42 higher value compared to measurement 0, while no statistically significant difference was found ($t=1.47$; $P=0.148$). In measurement 20 compared to measurement 0, a higher value of 9.02 was recorded, and the presence of a statistically significant difference was found ($t=2.44$; $P=0.018$).

Compared to measurement 5, measurement 10 found a higher value by 3.71 ($t=2.44$; $P=0.018$), while measurement 20 found a 10.31 higher value, and the presence of a statistically significant difference was found ($t=5.23$; $P<0.001$).

The value of HR in measurement 20 compared to measurement 10 was increased by 6.60, and the presence of a statistically significant difference was found ($t=3.74$; $P<0.001$).

Requirement for analgesics 1 and 3 hours after septorhinoplasty and breast augmentation

The most common drug one hour after surgery was paracetamol, which was used in 10 patients who had septorhinoplasty (22.73%), while the drug was used in 13 patients who had breast augmentation (27.08%), and no statistically significant difference was found

($P=0.630$). In most patients in both groups one hour after surgery, no analgesics were used: in 32 patients who underwent septorhinoplasty ($n=32$; 72.73%), and in 33 patients who underwent breast augmentation (68.75%); no statistically significant difference was found ($P=0.675$). (Figure 6 A,B)

Three hours after surgery, no analgesics were used in 43.18% patients who underwent septorhinoplasty, and in 58.33% patients who underwent breast augmentation (68.75%); no statistically significant difference was found. (Figure 6 C, D)

Without analgesics after three hours, patients who underwent breast augmentation (BLi&AD) group were 1.35 times more frequent than patients who underwent septorhinoplasty (Li&AD) ($P = 0.467$)

Discussion

This study showed the hemodynamic effect of two types of local infiltration anesthesia with lidocaine & adrenaline before septorhinoplasty and combination bupivacaine with lidocaine & adrenaline before breast augmentation, on the systolic, diastolic blood pressure and heart rate of young healthy adults who underwent day surgery under general anesthesia.

The mean value of systolic blood pressure (SBP) in all observed measurements before general anesthesia (0), immediately, 5 minutes, 10 minutes and 20

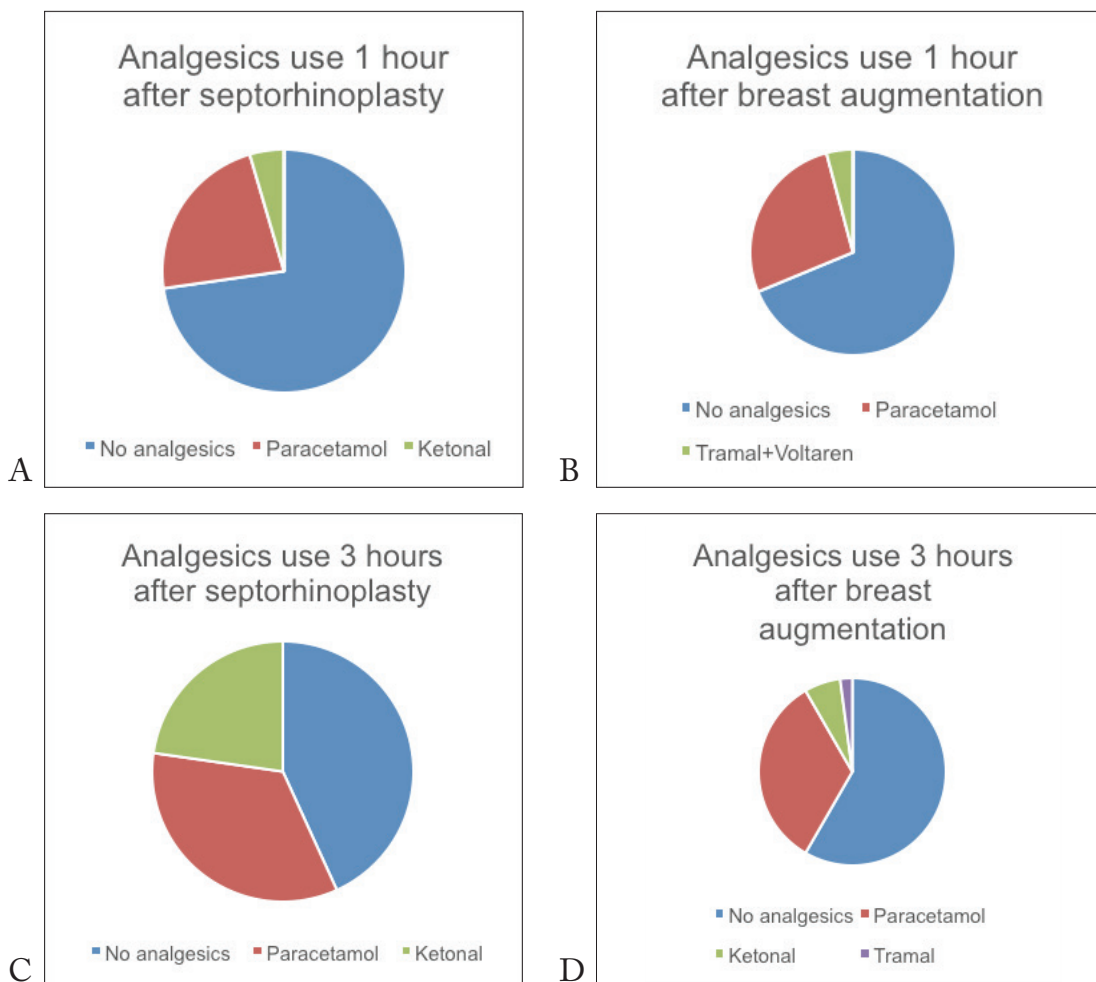


Figure 6 Requirement for analgesics in 1 hour and 3hour after septorhinoplasty(A,C) and breast augmentation (B,D)

minutes after local infiltration an aesthetic was higher among patients who underwent septorhinoplasty compared to patients who underwent breast augmentation. A higher mean value of diastolic blood pressure was found among patients who underwent septorhinoplasty compared to patients who underwent breast augmentation. The DBP level in the 20-minute measurement increased by 9.52 mmHg compared to the 10-minute measurement.

Although the heart rate did not differ significantly among patients who underwent breast augmentation compared to patients who underwent septorhinoplasty, patients who underwent septorhinoplasty showed significant increase of heart rate in measurement 20 minutes compared to measurement 10 minutes was

increased by 5.11 bpm after local infiltration anesthetics with adrenaline.

We believe our study is the important to assess the cardiovascular effects of different local anesthetics with vasoconstrictors on two type LIA and surgical localization. Adrenaline is known to increase the heart rate by stimulating b1 adrenergic receptors, and this effect was directly observed in our study in the septorhinoplasty group. In the elderly, the effect of adrenaline may be more pronounced.

Earlier studies have reported that systolic and diastolic blood pressures were not significantly increased when 1.8 mL of 2% lidocaine with 1:100.000 adrenaline was injected into older patients in healthy participants (12). However, in another study with healthy

participants, it was found that systolic blood pressure increased significantly ten minutes after the administration of lidocaine with adrenaline and diastolic blood pressure decreased significantly (13). Another study of 27 New York Heart Association class III patients showed that dental injection of 1.8 mL of Li & AD resulted in a significant increase in systolic blood pressure within two minutes after administration (14). In all these studies, the average age of the participants was less than 65 years. Inadequate anesthesia, pain during administration, and postoperative pain have been described. Locoregional techniques are superior in reducing pain in the first hour after mastectomy (8).

The use of vasoconstrictors in local anesthetics to increase local anesthetic efficacy and reduce systemic uptake is unquestioned. Elevated blood levels of epinephrine can occur with their use but do not generally appear to be associated with any significant cardiovascular effects in healthy patients or those with mild to moderate heart disease. Endogenous epinephrine released in day surgery treatment-related stress can also reach significant blood levels and make it difficult to determine cause of cardiovascular side effects. (1).

In our study, systolic blood pressure increased significantly transiently in the group receiving septorhinoplasty 20 minutes after LIA, but no significant change was observed in subsequent measurements.

It is possible that these changes could be due to differences in systemic diseases, medications, and/or differences in the dose of adrenaline contained in the local anesthetic or the amount of local anesthetic-vasoconstrictor used.

Ca'ceres *et al.* compared lidocaine without adrenaline and phenylephrine in patients with cardiac disease, and no difference in blood pressure changes after local anesthesia was reported. In our study, lidocaine with adrenaline increased both systolic and diastolic blood pressure. This variation could possibly be due to increased peripheral vascular resistance. Hemodynamic function may be modulated by the pharmacological action of the vasoconstrictor, or other factors such as preprocedure pain, pain from injection, or the effect of systemic diseases or medication used (16). There is a possibility that arteriosclerosis due to aging may have an effect on the results as well.

Meral *et al.* studied the adverse hemodynamic effects and plasma concentrations of lidocaine and epinephrine in healthy patients. The local anesthetic solutions used in their study were 2.0 mL of 2% lido-

caine with 1:100.000 epinephrine or 2.0 mL of plain 2% lidocaine. They indicated that increase in heart rate was recorded immediately after the injection (three minutes) in both groups (12).

Our analysis method and results are different from this previous research. Lavage of nasal flaps with lidocaine-adrenaline mixture seems an effective and simple way in the control of early postoperative pain, edema, and ecchymosis in septorhinoplasty patients. Inadequate anesthesia, pain during administration, and postoperative pain have been described (8). In our study, locoregional techniques are superior in reducing pain in the first hour after septorhinoplasty, so 72.73% need not analgesics, and after breast augmentation 68.75%, as well. In most of our patients in both groups three hours after surgery no analgesics were used: in 43.18% patients who underwent septorhinoplasty, and in 58.33% patients who underwent breast augmentation as result of prolong effect of bupivacaine.

In addition, it considerably reduces total analgesic consumption and patient discomfort, leading to high levels of satisfaction and early outcomes (10, 17-23). However, our study has some limitations. First, this study did not evaluate preoperative fear of anesthesia, which is known to affect blood pressure and heart rate. There is a need to investigate the effects of preoperative medications on the control of blood pressure and heart rate in relation to vasoconstrictor use. In our study, heart rate was increased, but this did not cause overt tachycardia (heart rate >100 bpm). This change may not be clinically significant for many patients. However, local anesthetics without adrenaline are recommended in patients with severe heart disease, such as unstable angina, severe valvular disease, certain dysrhythmias, or advanced congestive heart failure. For patients with paroxysmal atrial fibrillation and tachycardia, local anesthetics containing adrenaline may promote an acute episode of fibrillation.

Conclusions

Measured transient changes in heart rate and blood pressure after local infiltration of vasoconstrictor anesthetics in healthy patients prior to septorhinoplasty and breast augmentation may be triggered by endogenous and / or exogenous epinephrine. Bupivacaine solution for local infiltration analgesia reduced hemodynamic disturbances and prolonged analgesic effect. We highlight the need for careful preoperative evaluation, including anxiety assessment and treatment in all patients in day surgery.

Acknowledgements

The authors thank the medical staff of Bagatin Polyclinic and the students of Croatian Catholic University for their support and assistance.

References

- Manani G, Facco E, Casiglia E, Cancian M, Zanette G. Isolated atrial fibrillation (IAF) after local anaesthesia with epinephrine in an anxious dental patient. *Br Dent J* 2008;205:539–541.
- World Health Organization (WHO) The Top 10 Causes of Death. [(accessed on 29 September 2021)]. Available online: <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>.
- Sansone P, Giaccari LG, Faenza M, Pasquale Di Costanzo PD, Izzo S, Aurilio C, Coppolino F, Passavanti M B, Pota V, Pace MC. What is the role of locoregional anesthesia in breast surgery? A systematic literature review focused on pain intensity, opioid consumption, adverse events, and patient satisfaction *BMC Anesthesiol.* 2020 Nov 23;20(1):290. doi: 10.1186/s12871-020-01206-4
- Goranović, Tatjana; Pirk, Irena; Parazajder, Domagoj; Gudelj, Goran; Zdilar, Boris; Vučković, Branimir; Šimunjak Boris; Šakić, Kata The effect of injection speed on haemodynamic changes immediate after lidocaine/adrenaline infiltration of nasal submucosa under general anaesthesia // *Periodicum biologicorum*, **113** (2011), 2; 217–221
- Bagatin, Tomica; Bagatin, Dinko; Šakić, Livija; Šakić, Kata Impact of Local Infiltration Anesthesia on Postoperative Pain Management after Rhinoplasty in Day Care Surgery // *Acta clinica Croatica*, **58** (2019), suppl.1; 62–66 doi:10.20471/acc.2019.58.s1.09
- Šakić, Kata; Bagatin, Dinko; Bagatin, Tomica; Šakić, Livija; Jeleč, Vjekoslav; Včev, Aleksandar Comparison of Different Surgical Procedures with Local Infiltration Analgesia in Day Surgery // *Acta clinica Croatica*, **58** (2019), 1; 67–73 doi:10.20471/acc.2019.58.s1.10
- Elsayed M, Alosaimy RA, Ali NY, Alshareef MA, Althqafi AH, Rajab MK, Assalem AS, Khiyami AJ. Nerve Block for Septorhinoplasty: A Retrospective Observational Study of Postoperative Complications in 24 Hours *Cureus* . 2020 Feb 12;12(2):e6961. doi: 10.7759/cureus.6961.
- Serrera Figallo MA, Vela' zquez Cayo' n RT, Torres Lagares D, Corcuera Flores JR, Machuca Portillo G. Use of anesthetics associated to vasoconstrictors for dentistry in patients with cardiopathies. Review of the literature published in the last decade. *J Clin Exp Dent.* 2012;4:e107–e1
- Gutmann JL, Frazier LW Jr, Baron B. Plasma catecholamine and haemodynamic responses to surgical endodontic anaesthetic protocols. *Int Endod J.* 1996;29:37–42.
- Gümüs N. Lavage With Lidocaine and Adrenaline Mixture Reduces the Early Side Effects of Septorhinoplasty *Ann Plast Surg* . 2020 Jun;84(6):e29–e32. doi: 10.1097/SAP.0000000000002219.
- Yagiela JA. Vasoconstrictor agents for local anesthesia. *Anesth Prog.* 1995;42:116–120.
- Meral G, Tasar F, Sayin F, Saysel M, Kir S, Karabulut E. Effects of lidocaine with and without epinephrine on plasma epinephrine and lidocaine concentrations and hemodynamic values during third molar surgery. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2005;100:e25–e30.
- Hersh EV, Giannakopoulos H, Levin LM, et al. The pharmacokinetics and cardiovascular effects of high-dose articaine with 1:100,000 and 1:200,000 epinephrine. *J Am Dent Assoc.* 2006;137:1562–1571.
- Niwa H, Sugimura M, Satoh Y, Tanimoto A. Cardiovascular response to epinephrine-containing local anesthesia in patients with cardiovascular disease. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2001;92:610–616.
- Ca' ceres MT, Ludovice AC, Brito FS, et al. Effect of local anesthetics with and without vasoconstrictor agent in patients with ventricular arrhythmias. *Arq Bras Cardiol.* 2008; 91:128–133, 142–147.
- Abu-Mostafa N, Aldawssary A, Assari A, Alnujaidy S, Almutlaq A. A prospective randomized clinical trial compared the effect of various types of local anesthetics cartridges on hypertensive patients during dental extraction. *J Clin Exp Dent.* 2015;7:e84–e88.
- Brand HS, Bekker W, Baart JA. Complications of local anaesthesia. An observational study. *Int J Dent Hyg* 2009;7:270–272.
- van der Bijl P, Victor AM. Adverse reactions associated with norepinephrine in dental local anesthesia. *Anesth Prog* 1992;39:87–89.
- Kaufman E, Goharian S, Katz Y. Adverse reactions triggered by dental local anesthetics: a clinical survey. *Anesth Prog* 2000;47:134–138.
- Jean-Pierre T.F. Ho, Tom C.T. van Riet, Youssef Afrian, Kevin T.H. Chin Jen Sem, René Spijker, Jan de Lange, and Jerome A. Lindeboom Adverse effects following dental local anesthesia: a literature review *J Dent Anesth Pain Med.* 2021 Dec;21(6):507–525. English. Published online Nov 26, 2021. <https://doi.org/10.17245/jdapm.2021.21.6.507>
- Bagatin, Dinko; Šakić, Kata; Bagatin, Tomica; Šakić, Livija The Outcome of Breast Augmentation using Local Infiltration Anesthesia (LIA) // *Abstracts and Highlight Papers of the 35th Annual European Society of Regional Anaesthesia & Pain Therapy (ESRA) Congress 2016 ; u: Regional anesthesia and pain medicine 41 (2016) (S) e1–e162*
- Goranović, Tatjana; Šakić, Kata Perioperative evaluation of glycaemic status in neck dissection : a retrospective analysis at a single hospital centre // *Journal of oral and maxillofacial surgery*, **43** (2014), 6; 686–691 doi:10.1016/j.jom.2013.11.015
- Mottura A A. Local anesthesia in reduction mastoplasty for out-patient surgery. *Aesthetic Plast Surg* . Fall 1992;16(4):309–15. doi: 10.1007/BF01570693.

Sažetak

USPOREDBA HEMODINAMSKE FUNKCIJE KOD DVIJE VRSTE LOKALNE ANESTEZIJE S VAZOKONSTRIKTOROM U DNEVNOJ KIRURGIJI: RETROSPEKTIVNA STUDIJA

T. Bagatin, M. Škrčić, L. Šakić, D. Bagatin, J. Deutsch i K. Šakić

Sažetak

Hemodinamske promjene i aritmije srca nisu rijetkost u kliničkoj praksi, ovisne o osobinama bolesnika, kirurškom liječenju i primijenjenim lijekovima. Opisane su hemodinamske promjene koje su se razvile u mlađih bolesnika ubrzo nakon lokalne infiltracije anestezija u dnevnoj kirurgiji

Metode

Retrospektivno smo procijenili hemodinamski učinak 2% lidokaina s 0,0125 mg/ml adrenalina (Li & AD) primijenjenog za septorinoplastiku u 44 pacijenta i kombinacija od 0,5% bupivakaina i 2% lidokaina s 0,0125 mg/ml adrenalina (BLi & AD) za povećanje dojki u 48 sudionika. Krvni tlak i broj otkucaja srca bilježeni su prije uvida u opću anesteziju 0, te poslije 5, 10 i 20 minuta nakon primjene lokalne infiltracije anestetika (LIA) i podaci su analizirani.

Rezultati

Srednja vrijednost sistoličkog krvnog tlaka (SRR) u svim promatranim mjerenjima prije opće anestezije (0), odmah 5 minuta, 10 minuta i 20 minuta nakon lokalne infiltracije anestetika bila je viša kod pacijenata podvrgnutih septorinoplastici (Li & AD) u odnosu na pacijentice podvrgnute povećanju dojki, (BLi & AD) skupina ($p < 0.05$). Vrijednosti dijastoličkog tlaka (DRR) 20 minuta u odnosu na 10 minuta povećane su za 9,52 mmHg ($P < 0.05$). Pacijenti podvrgnuti septorinoplastici imali su značajan porast srčane frekvencije u 20 minuta nakon lokalne infiltracije anestetika s adrenalinom.

Zaključci:

Izmjerene prolazne promjene otkucaja srca i krvnog tlaka nakon lokalne infiltracije anestetika s vazokonstriktorima u zdravih pacijentica prije septorinoplastike i povećanja grudi mogu biti potaknute endogenim i/ili egzogenim adrenalinom. Bupivakain otopina za lokalnu infiltracijsku analgeziju smanjila je hemodinamske poremećaje i produžila analgetski učinak. Ističemo potrebu za pažljivom preoperativnom evaluacijom, uključujući procjenu anksioznosti i liječenje u svih pacijenata u dnevnoj kirurgiji.

Ključne riječi: *Lokalna infiltracijska anestezija; kardiovaskularne promjene, septorinoplastika, povećanje grudi.*