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The effect of bilateral infraorbital nerve block on hemodynamic changes during sinus endoscopic surgery

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ABSTRACT

Background: The present study examined the effect of bilateral infraorbital nerve block with marcaine on hemodynamic changes during sinus endoscopic surgery. *Material and Methods:* 30 patients underwent sinus endoscopy surgery in two groups: marcaine and normal saline. Ifraorbital nerve block was performed in the first group by injecting 1 ml of 0.5% marcaine for 30 to 40 seconds and in the second group by injecting 1 ml of sterile normal saline. The level of oxygen, pulse rate, and systolic and diastolic blood pressure were measured before anesthesia, 30 minutes and 60 minutes after anesthesia, at the time of completion of recovery surgery and exit from recovery. *Results:* The mean age of men was 37.29±10.15 and the mean age of women was 38.92±7.60. The mean systolic blood pressure of the marcaine group was less in comparison with the normal saline group 30 minutes ($p = 0.001$) and 60 minutes after the start of the anesthesia process, as well as at the time of surgery, at the time of entering the recovery and at the time of leaving the recovery ($p < 0.001$). The mean pulse rate of marcaine group was less than normal saline group 30 minutes ($p = 0.005$) and 60 minutes ($p = 0.019$) after the start of anesthesia and at the end of surgery ($p = 0.007$). *Conclusion:* Bilateral infraorbital nerve block with topical injection of marcaine has a greater effect on lowering systolic and diastolic blood pressure and pulse than normal saline injection.

Keywords: Sinus endoscopy, Bilateral block, Infraorbital nerve, Hemodynamic index, Marcaine.

1. INTRODUCTION

Sinus surgery is used to treat a number of diseases, such as sinusitis caused by sinus infections. This type of surgery has made significant progress in recent years. Sinus surgeries are among the commonest otolaryngology surgeries today. They are mainly performed endoscopically and cause a significant improvement in the clinical symptoms of patients with rhinosinusitis

(Bhattacharyya, 2004; Almoumen et al., 2020). Sinus endoscopic surgery is performed with minimal need for nasal dressing, mild pain, and short recovery period after surgery (Mehanna et al., 2002); however, due to the closure of the surgical site, small amounts of bleeding reduce the surgeon's vision and disrupt the surgical procedure (Kinoshita and Kawahito, 2018).

General anesthesia plays a major role in these surgeries and changes the condition significantly in favor of the surgeon, leading to less bleeding during the operation, easier working conditions, and easier anatomical diagnosis. These surgeries have few complications, but in case of significant bleeding, the anatomy of the operation site becomes unclear and affects the outcome of the surgery (Yaniv et al., 2006), followed by complications such as meningitis, blindness, entering the intracranial space, and increases of cerebrospinal fluid (CSF) leak (Wallace et al., 1995). Controlled hypotension impairs cerebral autoregulation and reduces CBF, especially in the elderly, leading to cerebral ischemia if the mean arterial pressure is less than 55-50 mm Hg. For this reason, controlled hypotension is contraindicated in these individuals (Visalyaputra et al., 2005). Furthermore, in patients with coronary arteries, controlled hypotension reduces coronary blood flow and the patient is prone to cardiac ischemia (Visalyaputra et al., 2005, Hachenberg, 2000). As these surgeries are associated with bleeding, they can cause hemodynamic disorders in the operated patients (Sadeghi et al., 2011). As mentioned, this type of surgery requires general anesthesia; complications of general anesthesia and injection of anesthetics and intravenous anesthesia can include unintentional extubation, twisting of the endotracheal tube, aspiration of blood and secretions, laryngospasm, acute airway obstruction and hemodynamic disorders, which less commonly reported in cases of local anesthesia.

Local anesthesia techniques such as infraorbital nerve block are less associated with the risk of airway involvement, respiratory failure and apnea, which are complications of anesthesia with opioids (Wang et al., 2015). Local anesthesia techniques such as infraorbital nerve block are less associated with the risk of airway involvement, respiratory depression, and apnea, which are complications of anesthesia with opioids (Wang et al., 2015). The anterior superior alveolar (ASA) nerve block, which is known as the infraorbital nerve block, causes anesthesia of the 5 anterior teeth of each maxillary quadrant.

In addition to anesthesia of the mucosa and buccal bone of these teeth, the upper lip, lateral wall of the nasal cavity, and the lower eyelid skin are also anesthetized. The present study was aimed to examine the effect of bilateral infraorbital nerve block on hemodynamic changes during sinus endoscopic surgery in patients referred to Shafa Hospital in Kerman in the first half of 2021.

2. MATERIALS AND METHODS

The statistical population of this single-blind clinical trial included patients aged 18-65 years with ASA 1 and 2 candidates for sinus endoscopic surgery referred to Shafa Hospital in Kerman during the first six months of 2021. Based on the information achieved from previous studies, size of the sample was calculated, and finally using convenience sampling, in each group 15 people in each group were included. Inclusion criteria included patient satisfaction to continue participating in the study, ASA class 1 and 2, age 18-65 years, ability to speak fluently in Persian, no diseases with chronic pain such as cancer, diabetes, neuropathy, multiple sclerosis, dialysis, Spinal disorders, Chronic mental illness, Oral and maxillofacial abnormalities, History of seizures, History of brain surgery, and History of concussion.

Exclusion criteria: The patient was dissatisfied with the continuation of the study. The tool of this study was a checklist for recording demographic information. Pulse oximeter and arm sphygmomanometers were used to measure arterial oxygen and blood pressure, respectively.

After the approval of the study in the ethics committee (IR.KMU.AH.REC.1399.060), sampling was conducted. After selecting the patients, the purpose of the study was explained to patients in detail. Informed consent was obtained from patients. The patients were then transferred to the operating room in NPO mode and underwent a routine general anesthesia procedure. Based on the lottery, number 1 was assigned to the group treated with normal saline and number 2 to the group treated with arcaine. Thus, individuals were assigned to the marcaine or normal saline group. The nerve block was performed by a trained anesthesia resident under Attendant's supervision. Anterior Superior Alveolar (Infraorbital) Nerve Block causes anesthesia of the 5 anterior teeth of each maxillary quadrant. In addition to anesthesia of the mucosa and buccal bone of these teeth, lateral wall of the nasal cavity, the lower eyelid skin, and the upper lip are also anesthetized. In the extracorporeal method, the infraorbital foramen is palpated. A needle number 25 to 27 goes directly to the foramen (cephalic to the medial) until it encounters bone resistance. Because the foramen infraorbital axis is intermittently porous and orbital, a lateral to medial approach reduces the risk of foramen perforation. One finger is always placed on the surface of the infraorbital foramen to prevent the needle from advancing toward the cephalic. It is also recommended to prevent hematoma formation by applying pressure (Hadzic, 2017). After 2 negative aspirations, 1 ml of 0.5% bupivacaine was injected within 30 to 40 seconds. After that, surgery began.

In the control group, infraorbital nerve block was performed using sterile normal saline injection and patients under general anesthesia underwent sinus endoscopic surgery by a surgeon. From the start of surgery, the patient's hemodynamic parameters including pulse rate, systolic and diastolic blood pressure and arterial oxygen saturation were recorded every 30 minutes until the patient left recovery and entered the hospital ward. All information was entered in the study checklist. The measurement of blood pressure, pulse and arterial oxygen saturation of all patients was performed by one hand and by one of the anesthesia residents who did not know the patient grouping.

Statistical analysis

Significance level of Kolmogorov-Smirnov test Diastolic blood pressure scores were significant (p = 0.037) which prevented the performance of parametric tests, but the skewness and elongation of hemodynamic indicators at different stages of measurement was in the range of 2. Therefore, due to the small sample size and omission, parametric tests are not prohibited. Finally, the obtained data were analyzed using independent t-test. Kolmogorov-Smirnov test level was significant for diastolic blood pressure scores upon arrival (p = 0.037), which prevents parametric tests. But the skewness and elongation of hemodynamic parameters in different stages of measurement was in the range of 2%. Due to the small sample size and omission, parametric tests are not prohibited. Finally, the obtained data were analyzed using independent t-test.

3. RESULTS

The differences between men and women in terms of age was not significant (p = 0.632). Also, the mean age of men and women in the group treated with marcaine (p = 0.481) and the group treated with normal saline (p = 0.938) was not significantly different. Besides, the mean age of the marcaine and normal saline -treated groups was found to be 39.80±10.36 and 39.20 ± 7.63 years. No significant difference was found between the two groups in terms of age (p = 0.476). Although the mean age of men in the normal saline-treated group was higher than the marcaine -treated group, this difference was not significant (p = 0.412). Finally, the mean age of women in the group treated with marcaine was not significantly different from the group treated with normal saline (p = 0.975).

Table 1 provides information on the comparison of mean systolic and diastolic blood pressure, and pulse rate of the two groups of marcaine and normal saline at different times of measurement. Although the mean systolic pressure of the normal saline group was higher compared to the marcaine group at the time of admission, but this difference was not significant (p = 0.388). The mean systolic blood pressure of the marcaine group was less compared to the normal saline group 30 minutes (p = 0.001) and 60 minutes after the start of the anesthesia process, as well as at the time of surgery, at the time of entering the recovery and at the time of leaving the recovery (p <0.001). At baseline, the mean diastolic blood pressure of the normal saline group was not significantly different from the diastolic blood pressure of the marcaine group (p = 0.229).

The mean diastolic blood pressure of marcaine group in 30 minutes (p = 0.001) and 60 minutes (p = 0.013) after the start of anesthesia was lower than normal saline group. The mean diastolic blood pressure of the two groups at the time of surgery (p = 0.126), entry into recovery (p = 0.530) and exit from recovery (p = 0.853) was not significantly different. Also, the mean number of pulses of the two groups at the time of arrival was not significantly different (p = 0.246). The mean pulse rate of marcaine group was less than normal saline group 30 minutes (p = 0.005) and 60 minutes (p = 0.019) after the start of anesthesia and at the end of surgery (p = 0.007).

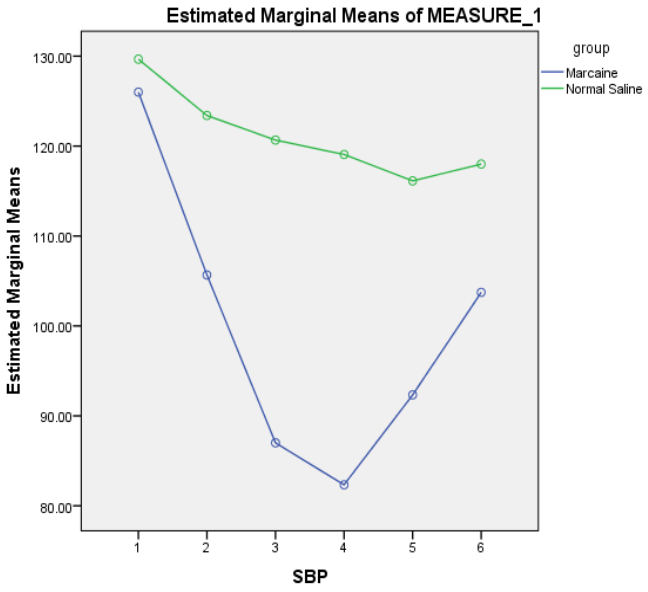
The mean pulse rate of the two groups was not significantly different at the time of entry into recovery (p = 0.25) and exit from recovery (p = 0.946). The results of repeated measures test showed that in the marcaine and placebo groups, the trend of changes in systolic and diastolic blood pressure and pulse rate decreased significantly (p <0.05). For assessment of the changes in systolic and diastolic blood pressure and pulse rate of the two groups at different stages, Cohen's d effect size was applied. The Cohen's effect size of the marcaine group was greater than the size of the Cohen's effect of the normal saline group at all stages of systolic blood pressure measurement. Hence, comparing the variations in systolic blood pressure in both groups of Marcaine and normal saline showed a greater percentage of it in Marcaine group.

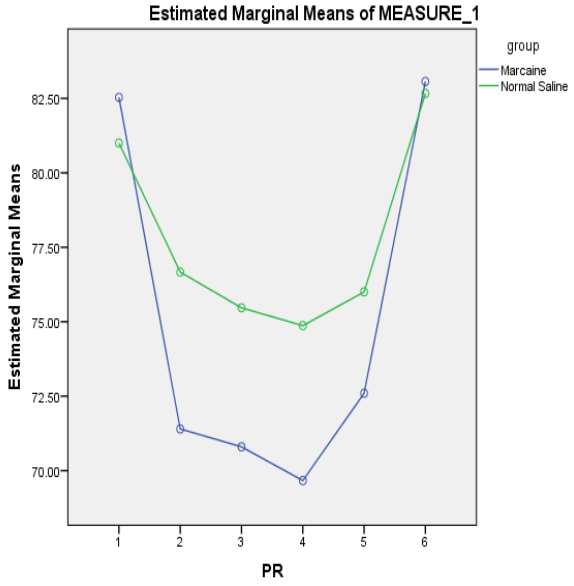
Mean diastolic blood pressure at the onset stage was 30 minutes later, at the end of the surgery stage at the recovery stage, and at the recovery stage from the recovery stage, the Markain group was higher than the normal saline group. In addition, the changes in pulse rate in the marcaine group were greater than the normal saline group (Table 2).

Table 1 Mean systolic blood pressure (SBP), diastolic blood pressure of the two groups treated with marcaine and normal saline at different times of measurement

Variable	Measurement time	marcaine	normal saline	p-value*
Blood pressure Systolic	Upon arrival	126/0±8/58	129/67±13/66	0/388
	30 minutes later	105/67±8/51	123/40±13/16	0/001
	60 minutes later	87/00±2/53	120/67±12/49	<0/001
	Completion of surgery	82/33±1/95	119/07±11/38	<0/001
	Entry to recovery	92/33±3/90	116/13±10/03	<0/001
	Exit recovery	94/67±5/75	113/0±8/19	<0/001
	p-value**	<0/001	<0/001	
Blood pressure Diastolic	Upon arrival	81/33±3/67	79/00±7/70	0/229
	30 minutes later	65/80±5/10	77/80±9/28	0/001
	60 minutes later	66/73±4/88	73/60±8/69	0/013
	Completion of surgery	66/40±5/68	72/33±13/20	0/126
	Entry to recovery	72/20±4/68	74/27±11/60	0/530
	Exit recovery	77/60±2/32	77/07±10/73	0/853
	p-value**	<0/001	0/043	
Pulse count	Upon arrival	83/73±6/48	81/00±6/66	0/265
	30 minutes later	73/27±2/37	76/67±3/60	0/005
	60 minutes later	71/00±2/24	74/27±4/43	0/019
	Completion of surgery	69/67±4/85	75/60±6/14	0/007
	Entry to recovery	72/47±2/10	74/67±4/88	0/125
	Exit recovery	83/07±6/58	82/93±3/67	0/946
	p-value**	<0/001	<0/001	

*: Independent t-test **: Frequent measurement test





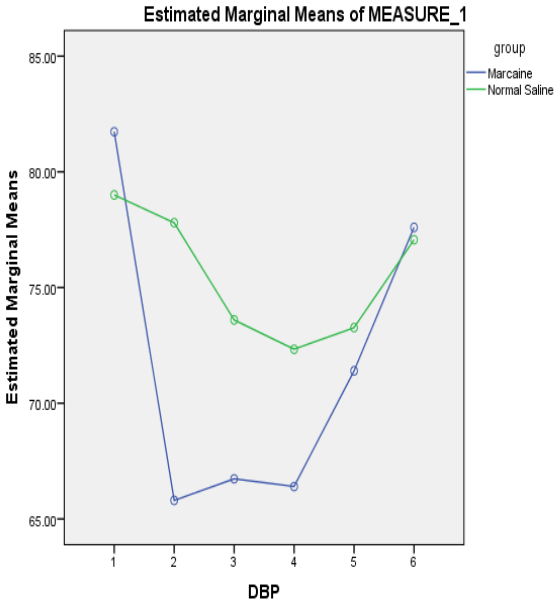


Figure 1 Trend of changes in SBP, DBP and PR in 6 stages of measurement in marcaine and normal saline groups

Table 2 Comparison of Cohen effect size in the group treated with marcaine and normal saline in different stages of measuring SBP, DBP and PR

Variable	Measurement steps	Cohen's d		Comparison result
		marcaine	normal saline	
Systolic blood pressure	Upon arrival - 30 minutes later	2/379	0/467	Marcaine> Normal Saline
	30 minutes later - 60 minutes later	2/974	0/213	Marcaine> Normal Saline
	60 minutes later - completion of surgery	2/067	0/134	Marcaine> Normal Saline
	Completion of surgery-entry into recovery	3/243	0/274	Marcaine> Normal Saline
	Enter Recovery - Exit Recovery	0/476	0/342	Marcaine> Normal Saline
Diastolic blood pressure	Upon arrival - 30 minutes later	3/495	0/141	Marcaine> Normal Saline
	30 minutes later - 60 minutes later	0/186	0/467	Marcaine> Normal Saline
	60 minutes later - completion of surgery	0/062	0/114	Marcaine> Normal Saline
	Completion of surgery-entry into recovery	1/114	0/156	Marcaine> Normal Saline
	Enter Recovery - Exit Recovery	1/462	0/250	Marcaine> Normal Saline
Pulse count	Upon arrival - 30 minutes later	2/144	0/809	Marcaine> Normal Saline
	30 minutes later - 60 minutes later	0/984	0/594	Marcaine> Normal Saline
	60 minutes later - completion of surgery	0/352	0/248	Marcaine> Normal Saline
	Completion of surgery-entry into recovery	0/749	0/168	Marcaine> Normal Saline
	Enter Recovery - Exit Recovery	2/170	1/913	Marcaine> Normal Saline

4. DISCUSSION

The present study evaluated the effectiveness of the bilateral infraorbital nerve block technique on hemodynamic changes during sinus endoscopic surgery. In this study, 30 patients were studied in two groups treated with marcaine and normal saline. The data from the present study revealed that bilateral infraorbital nerve block caused a significant reduction in systolic blood pressure during surgery. Although these changes were also seen in the normal saline group, but the Cohen's effect size showed that due to almost identical patient conditions (no significant difference in age, surgery in a hospital and the same surgeon in the same way) the changes in the marcaine group were more, that it is resulted from a nerve block. Haji Gholam et al., (2017) study compared the

efficiency of local pethidine in comparison with intravenous pethidine in patients undergoing bilateral infraorbital nerve block, where a significant difference was found between the two groups in terms of heart rate, mean arterial pressure, consciousness and postoperative pain score. Also, no significant difference was found between the two groups in terms of time of surgery, better recovery time, receiving the first dose of analgesia, number of doses of analgesia received and frequency of side effects.

The results of Wang et al., (2015) study showed that general anesthesia with infraorbital nerve block was detected to be effective in decrement of using isoflurane and also decreasing the severity of postoperative pain sinus endoscopic surgery. Kaçar et al., (2020) showed that bilateral infraorbital nerve and infraoptic nerve blocks in septorhinoplasty were detected to be a simple, efficacious, and reliable technique the treatment of postoperative pain. Choi et al., (2019) performed bilateral infraorbital nerve and infratrochlear nerve blocks 30 minutes before septorhinoplasty for postoperative analgesia. Wang et al., (2015) investigated the analgesic effect of postoperative infraorbital nerve block on cleft lip after injection of bupivacaine and saline in the marcaine and control groups. In both studies, the differences between the block group and the control group in terms of duration of surgery and anesthesia was not significant (Choi et al., 2019; Wang et al., 2015). Two studies performed bilateral infraorbital nerve and infratrochlear nerve blocks for investigating the effectiveness of postoperative analgesia in septorhinoplasty operation. They reported that postoperative analgesia reduced in comparison with the control group (Choi et al., 2019; Boselli et al., 2016). Çekiç et al., (2013) reported a decrement in postoperative analgesia in two groups, in which the group under bilateral infraorbital nerve block was compared with the control group in rhinoplasty. In our study the patients who received dexketoprofen agent after the operation were lower in the block group compared to the control group at 0-2 hours, 2-8 hours and 8-24 hours after surgery.

In a similar study by Rajamani et al., (2007) compared the effectiveness of analgesia with Intravenous (IV) Fentanyl and bilateral infraorbital nerve block. The group receiving bilateral infraorbital nerve block had more complete anesthesia, less mean time to awakening, less time to feed. Also, these researchers did not report serious complications in the two study groups. The data from the present study revealed that administration of bilateral infraorbital nerve block with Marcaine was more effective compared with its administration with normal saline. The differences observed between the present study and the study of Rajamani et al., (2007) may be due to the type of opioid compound and the amount of doses used, as well as differences in the criteria used to evaluate the effectiveness of the studied methods.

Although several studies showed that using bilateral infraorbital nerve block in control group who received saline injections was more effective compared to the other studied groups, the present study is one of the few studies that examined nerve block with marcaine in sinus endoscopic surgery. In the study of Mane et al., (2011) 45 children who were candidates for cleft lip repair surgery were separated to three groups. In one group of patients, marcaine was used alone, in the other group, marcaine and pethidine, and in the third group, marcaine and fentanyl were used for applying the technique of bilateral infraorbital nerve block. Based on the data from the present study the duration of anesthesia in the group receiving marcaine and fentanyl was higher than the group receiving marcaine and pethidine; in this group, it was more than the group receiving marcaine alone. As a result, adding fentanyl and pethidine to marcaine for performing the technique of bilateral infraorbital nerve block can increase the duration of anesthesia without any serious side effects.

Fundamental differences was found between the studied group of participants in this study and groups studied by Mane et al., (2011) because the study has not investigated the effect of intravenous injection of pethidine, which can lead to contradictory results in comparison with the present study. In a similar study, the effectiveness of adding pethidine to marcaine on anesthesia through the technique of bilateral infraorbital nerve block was examined among 40 children who undergo Cleft Palate Repair surgery. The data from the present study revealed that adding pethidine to marcaine increased the duration of anesthesia after bilateral infraorbital nerve block. However, this study also differs from the present study; in this study, only the effect of adding pethidine to marcaine in topical injection was investigated and the effect of intravenous pethidine was not investigated (Jonnavithula et al., 2007).

In a prospective study, Mayer et al., (1997) investigate the effectiveness of infraorbital nerve block during anesthesia of cleft lip. The researchers found that anesthesia could be used among infants with cleft lip or palate using the technique of bilateral infraorbital nerve block through a safe, simple and rapid procedure, which could cause a long-term analgesia. This technique is effective in reduction of the risk serious respiratory depression and enable immediate and comfortable awakening. Although the present study and similar studies have not reported serious complications from the use of opioids for further anesthesia in bilateral infraorbital nerve blocks, respiratory suppression is recognized as a very important complication of opioids, requiring serious attention. Although the use of pethidine for infraorbital nerve block has shown acceptable results compared to saline, the study of Haji Gholam et al., (2017) did not show any difference between topical injection and intravenous injection in terms of pain, complications and longer duration in recovery of children under cleft lip surgery.

Feriani et al., (2016) concluded in their study that it could not be proved easily that administration of infraorbital nerve block with lignocaine or bupivacaine is more capable of decreasing postoperative pain in pediatric patients with cleft lip in comparison with placebo and intravenous analgesics. The results of Mariano et al., (2009) study showed that although the infraorbital nerve injection under standard general anesthesia could not significantly decrease the length of stay in recovery until discharge, it had a significant effect on reducing postoperative pain. It is suggested that further studies be performed with higher sample sizes, other drugs, and different surgeries to better determine the effectiveness of this method. This study was performed on patients undergoing sinus endoscopic surgery with low sample size. Therefore, similar studies may result in different findings.

5. CONCLUSION

The decrease in systolic and diastolic blood pressure, and the decrement of pulse in bilateral infraorbital nerve blocks using marcaine was found to be greater than normal saline. Therefore, marcaine can be used in this nerve block, although further studies with higher sample sizes are needed.

Consent for publication

All authors declare that they have Consent for publication

Authors' contributions

All authors contributed to the design of the study, as well as data collection and analysis, and the writing of the manuscript. All authors read and approved the final manuscript.

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Conflict of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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