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Use of Dexmedetomidine as a Local Adjuvant Infiltration Agent in Septorhinplasty: New Infiltration Formula

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Abstract: Septorhinoplasty is a common cosmetic surgery nowadays. Local anaesthetic mixture with adrenaline was preferably used for obtaining bloodless surgical field and adequate perioperative analgesic strategy. Dexmedetomidine as a selective α2-agonist may be useful as an additive agent that helps in achieving a suitable surgical field and postoperative proper pain management. Patients and method: Eighty patients who were scheduled for elective septorhinoplasty umder general anesthesia were divided into two groups, each included 40 Patients. Group I: patient received local anaesthesia and adrenarline, group II: patient received the same as group I besides dexmedetomidine 100 µg. Heart rate, mean arterial blood pressure changes were monitored. Surgical and operative times were reported. The level of sedation and postoperative pain were evaluated by Ramsay Sedation Scale (RASS) and Visual Analogue Scale (VAS) respectively. The amount of analgesic requirement and the time till first analgesic requirement were also recorded. Surgeon and Patients' satisfaction with anesthesia were questioned one week after discharge. Results: Heart rate and mean arterial blood pressure were significantly decreased in group II compared with group I. RASS score was higher and VAS score and bleeding was lower in group II compared to group I. Surgeons and patients satisfaction was higher in group II compared to group I. Conclusion: In conclusion, supplementation of local anesthesia with dexmedetomidine produces an adequate level of intraoperative hemodynamic stability, conscious sedation, adequate analgesia, low postoperative analgesic requirements with extended pain free period and less bleeding in all patients. These effects are well obtained with high dose of dexmedetomedine.

Keywords: Septorhinplasty, Dexmedetomidine, Infiltration, Sedation

1. Introduction

Septorhinoplasty is a common corrective surgery in modern nasal surgery. Bloodless surgical field is a fundamental surgical requirement that facilitates the surgical intervention and improves the outcome [1]. Good perioperative analgesic strategy is also essential for proper surgery and patient satisfaction.

General anesthetic administration is the standard anesthetic approach for rhinoplasty surgery, which provides reasonable amnesia, analgesia and sedation. Meanwhile, without combination of local anesthetics, general anesthesia cannot provide bloodless operative field, attenuation of hemodynamic response to surgical stimulation or adequate postoperative pain relief. Therefore, the use of complementary local anaesthetic infiltration can strongly help in obtaining dry surgical field and adequate pain relief, which reduces stress response, arterial blood pressure and hence surgical bleeding [1, 2].

Different adjuvants have been added to local anesthetic medications in order to obtain more vasoconstriction or improve its analgesic duration and efficacy. Epinephrine added lidocaine is clearly understood and established local mixture infiltration in all rhinoplasty procedures [3].

Dexmedetomidine is a centrally acting highly specific α2-

agonist commonly used as sedative, preemptive analgesic [4] and to maintain stable hemodynamics in many surgeries [5]. Also, it has been used as an additive to local anesthetics in peripheral nerve block, brachial plexus block [6] and subarachnoid anesthesia.

Up to our knowledge, no previous studies had investigated the local hemostatic effect of dexmedetomidine on local injection for septorhinoplasty surgery or prolongation of local anesthesia duration [7-9].

Herein, we hypothesis that the use of 100 μg of dexmedetomidine as an adjuvant to local anesthetic medications infiltration in septorhinoplasty would extend the postoperative analgesic duration and result in proper bloodless operative field.

This study aimed at investigating the effect of using dexmedetomidine as an adjuvant to local anesthetic infiltration in septoplasty on postoperative analgesic efficacy the surgical field hemostatic condition.

2. Patients and Methods

This prospective randomized study was approved by the institutional ethical committee of Mansoura University. eighty patients who were scheduled for elective septorhinoplasty surgery and gave participation agreement and informed written consent were enrolled in this study at Mansoura university hospital between September 2015 to December 2016.

Inclusion criteria: All patient with American Society of Anesthesiology (ASA) physical status I or II patients of either sex, aged 18-60 years, with no coagulation disorders and no opioid use within the last week before surgery were included in this study.

Patients with history of hypersensitivity to the study drugs, significant cardiovascular disease (second [Mobitz II type] or third degree heart block, congestive heart failure, chronic heart failure (New York heart association [NYHA] III-IV), symptomatic coronary artery disease, uncontrolled hypertension, body mass index (BMI)>35, uncontrolled diabetes (blood sugar >250 recorded in last 30 days or HbA1c >7.5%), chronic clonidine therapy, hepatic impairment (CHILD B or higher), renal impairment, ongoing drug or alcohol abuse, pregnancy, revision surgery and nasal allergy were excluded from the study. General anesthesia for every patient was induced using intravenous fentanyl 2 μ g/kg, propofol 1.5–2.5 mg/kg and rocuronium 1 mg/kg to facilitate tracheal intubation. Anesthesia was maintained by isoflurane (0.1–1.5 MAC) in air–oxygen mixture (FiO_2 40%).

Patients were randomly divided into two groups using computer generated randomization program and closed envelope:

Group I: Infiltration of a mixture of bupivacaine 0.5% (4 ml) + lidocaine 2% (4 ml) + normal saline (1 ml) + 1 ml of adrenaline (1:50,000).

Group II: Infiltration of a mixture of bupivacaine 0.5% (4 ml) + lidocaine 2% (4 ml) + dexmedetomidine 100 μg (1 ml) + 1 ml of adrenaline (1:50,000).

In order to reduce the regional blood supply and obtain more effective sensory block, local infiltration was done to the whole nasal units and specific areas of surgery.

All patients were assessed intra-operatively and post-operatively for following:

1. Hemodynamic stability during surgery in both groups including heart rate and mean arterial blood pressure.
2. Total operating time and surgical operating time in both groups.
3. Intra operative and postoperative bleeding in both groups.
4. Grading of postoperative pain and sedation status.
5. Need for rescue analgesic and time till first analgesic requirements.
7. Satisfaction of patient and surgeon in both groups

Pain was measured by using visual analogue scale (VAS); sedation was assessed using Ramsay scale (RASS). Patient's satisfaction (quality of breathing, pain and soring) and surgeon's satisfaction (surgical field, bleeding, postoperative course and complications) were evaluated using LIKERT scale [10] where 0 represents no satisfaction and 5 represents the highest satisfaction. Total operating time was the total time of the patient stayed in the operation theatre. Surgical operating time was the time from starting of the local infiltration until the end of surgical procedure.

Intra operative bleeding was defined as minimal, moderate and severe bleeding. Minimal bleeding implies the surgical field was cleared with gauze and no major suctioning was needed. Moderate bleeding implies frequent suctioning was required to clear the surgical area of blood, but the bleeding didn't threaten the surgical field. Severe bleeding implies that the bleed threatened the surgical field and posed difficulty for the operating surgeon.

Sample size was calculated based on previous study which compared VAS score at different time intervals between patients. We choose values of VAS score at 6th hour for sample size calculation. The calculated samples size is 32 patients in each arm with α=0.05 (two tailed) and β=0.8 (Sigma Plot 12.0; Systat Software Inc., USA). We intentionally increased the number of participants to 40 at each arm to compensate for dropout and missed cases [11].

The collected data were analyzed via the SPSS version 24 (SPSS Inc., Chicago, IL, USA). The normality of data was tested using the Kolmogorov-Smirnov test. Chi square or Fisher's exact test were used for categorical data analysis. Continuous normally distributed data were analyzed using independent sample t-test. Non-parametric data were analyzed using Kruskal-Wallis and post-hoc Wilcox on rank sum t-tests, when appropriate. Data were expressed as mean±SD; median and range and number (percent). P value < 0.05 was considered significant.

3. Results

A total of fifty patients met the inclusion criteria were enrolled and all completed the study. There were no significant differences between groups with respect to age,

gender, total operative time and total surgical time (Table 1).

Table 1. *Demographic characteristics, total operative and surgical times of the studied groups. Data are expressed as mean±SD or numbers and percentage (%).*

		Group I (n=40)	Group II (n=40)	p
Age (years)		28.40±4.367	26.70±8.156	0.249
Gender	Male	23 (57.5%)	21 (52.5%)	0.293
	Female	17 (42.5%)	19 (47.5%)	
Total operative time (minutes)		108±8.16	109.16±5.97	0.277
Total surgical time (minutes)		91.28±5.64	94.88±4.62	0.148

In Table 2 a significant reduction in heart rate from the 30th intraoperative minute to the 90th intraoperative minute in group II patients when compared to group I.

Table 2. *Heart rate (beat/minute) in the studied groups. Data are expressed as mean±SD.*

	Group I (n=40)	Group II (n=40)	p
Basal	86.16±9.78	86.36±7.50	0.297
15 minutes	96.44±8.52	93.40±11.02	0.275
30 minutes	94.68±8.85	88.68±12.03*	0.036
45 minutes	95.68±11.91	86.36±13.04*	0.004
60 minutes	94.25±8.69	81.88±11.89*	0.012
75 minutes	94.84±10.83	85.80±14.79*	0.004
90 minutes	92.20±9.25	84.72±12.74*	0.016
105 minutes	93.20±9.84	86.84±14.64	0.310
120 minutes	91.17±10.02	87.80±13.64	0.342

* P<0.05 when group II compared with group I.

In Table 3 MAP was lower from the 30^{th,} 45th and 75th minutes intraoperative in group II patients in comparison to group I.

Table 3. *Mean arterial blood pressure (mmHg) in the studied groups. Data are expressed as mean±SD.*

	Group I (n=40)	Group II (n=40)	p
Basal	82.96±13.79	85.21±13.25	0.340
15 minutes	86.28±15.06	85..88±14.46	0.274
30 minutes	94.08±13.97	83.12±11.27*	0.019
45 minutes	93.12±17.35	81.36±12.78*	0.027
60 minutes	91.72±14.22	81.60±14.73	0.025
75 minutes	91.52±17.38	80.43±15.23*	0.042
90 minutes	89.20±11.75	85.88±16.96	0.127
105 minutes	90.12±12.45	86.44±14.91	0.252
120 minutes	91.01±13.02	88.75±14.65	0.321

* P <0.05 when group II compared with group I.

The average RASS score was higher during the first 2 hours postoperative in group II when compared to group I Table 4.

Table 4. *Ramsay Sedation Scale in the studied groups. Data are expressed as median and range.*

RASS	Group I (n=40)	Group II (n=40)	p
1 hour	2 (1-2)	3 (2-3)*	0.010
2 hours	1 (1-2)	3 (2-3)*	0.015
6 hours	1 (0-1)	1 (1-2)	0. 431
12 hours	1 (0-1)	1 (1-2)	0.320

* P <0.05 when group II compared to group I.

The mean postoperative VAS scores of group II was lower than its values in group I at the 2nd and 6th hours postoperatively Table 5.

Table 5. *VAS score in the studied groups. Data are expressed as median and range.*

VAS	Group I (n=40)	Group II (n=40)	p
One hour	2 (1-3)	1 (1-2)	< 0.251
Two hours	4 (2-5)	1 (1-2)*	0.043
Six hours	4 (3-6)	3 (2-4) *	0.042
12 hours	5 (3-7)	4 (2-4)	0.781

* P <0.05 when group II compared to group I.

The number of patients who required analgesia was significantly lower in group II (22.5%; P<0.001), when compared with group I, in addition, first request for analgesia and the total post-operative analgesic consumption showed statistically significant differences in group II when compared with group I Table 6.

Table 6. *patients required analgesia and post-operative analgesic profile in the studied groups Data are expressed as mean±SD, number and %.*

	Group I (n=40)	Group II (n=40)	p
Patients who required analgesia	37.5% (15)	20% (8)	< 0.001
First request for analgesia (hours)	2.44±0.51	4.21±0.89*	0.007
Total post-operative analgesic consumption (µg)	7.12±0.83	3.92±0.89*	0.014

* P < 0.05 when group II compared to group I.

Bleeding was lower in group II when compared to group I Table 7.

Table 7. *Bleeding score in the studied groups. Data are expressed as median and range.*

	Group I (n=25)	Group II (n=25)	p
Bleeding score	3 (2-3)	1 (1-2) *	0.048

* P <0.05 when group II compared to group I.

In table 8, Surgeon and patient were more satisfied in group II than in group I.

Table 8. *Satisfaction of surgeon and patient after surgery after 1 week in the studied groups. Data are expressed as median and range.*

	Group I (n=25)	Group II (n=25)	p
Surgeon satisfaction	3 (3-4)	4 (4-5) *	< 0.032
Patient satisfaction	3 (3-4)	5 (4-5) *	0.041

* P <0.05 when group II compared to group I.

4. Discussion

Septorhinoplasty is one of the most widely performed operations but it is considered as high risk operation, mainly because of several complications and the limited predictability of the results [12]. Complications that may arise from this procedure include excessive bleeding, extraocular muscle damage, cerebrospinal fluid rhinorrhea, septal abscess, wound infection, septal perforation, saddle nose deformity; nasal tip depression [13, 14].

Local and general anesthetics have been used to successfully perform septoplasty [15, 16].

In practice, a mixture of Lidocaine and bupivacaine is often used to provide fast and long duration of sensory blockade [17], but the cardiovascular toxic effects of local anesthesia are well documented [18]. Besides, vasoconstrictors as adrenaline are used with local anesthesia to control bleeding in the operative area [19, 20], but it could induce cardiac troubles such as cardiac arrhythmia.

In this study we found that preoperative addition of dexmedetomidine to bupivacaine and lidocaine significantly decreased heart rate and MAP. Dexmedetomidine is unique sedative and analgesic, which mediate its effect by selective stimulation of α2- adrenoreceptors on presynaptic neurons with reduction of norepinephrine release causing attenuation of central nervous system excitation [21]. Moreover, central nervous system activation of postsynaptic receptors by α2-agonists leads to inhibition of sympathetic activity with reduction of heart rate and blood pressure and results in sedation [21, 22].

Therefore, dexmedetomidine can be used as an anesthetic adjuvant during various surgical procedures to promote perioperative hemodynamic stability besides reduction of anesthetic and analgesic requirements [23, 24]. Recently, the use of dexmedetomidine in sinonasal operations has proved to be beneficial in providing sedation and reduction of surgical bleeding due to its sympatholytic effect [25, 26].

Dexmedetomidine has been shown to provide hypotensive anaesthesia during sinonasal operations under general and local anaesthesia [25, 27]

Although the most common adverse effects after administration of dexmedetomidine are hypotension and bradycardia but adrenaline administration restored both parameters with no risk of hemodynamic instability [28].

The current study, group III achieved more sedation after dexmedetomidine administration than those of group I or II. The conscious sedation obtained by dexmedetomedine provides additional advantages including preserved airway reflex and rapid recovery [29]. Also, in the study, we observed increased dose of dexmedetomidine may offer beneficial effects compared to the lower dose.

In the same way, the number of patients who required analgesia was significantly lower in both groups who had dexmoditiodoine compared with the first group without dexmedetomedine. Moreover, the first request for analgesia in the postoperative period was significantly longer with dexmedetomidine infusion compared with group I.

Dexmedetomidine is known to have an analgesic-sparing effect [30, 31], so dexmedetomidine could potentially reduce postoperative analgesic intake as reported in our study and in turn decrease the risk of developing analgesic's complications. Also, Turgut et al has reported that

dexmedetomidine has both anesthetic and analgesic effects in addition to its sedative effects [32].

Although adequate analgesia was achieved when using dexmedetomidine with local anaesthesia was reported previously during sinus surgery and septoplasty [3, 26].

In this study, bleeding was lower in the dexmedetomedine groups compared to group I. Dexmedetomidine through its stimulant effect on α2- adrenoreceptors in presynaptic neurons decreases norepinephrine release with subsequent reduction in central nervous system excitation with reduction in heart rate and blood pressure [21]. Therefore, dexmedetomidine can decrease the surgical bleeding due to its sympatholytic effect [25, 26] Ayoglu et al., demonstrated that, dexmedetomidine reduced bleeding during septoplasty [25].

Patient's satisfaction one week after surgery was higher in dexmedetomidine admistered groups. This could be attributed to the effective intraoperative analgesia, sedation and the effective pain management with lower analgesic dose and hence few adverse effects [3, 26]. Surgeon satisfaction was higher in dexmedetomidine administered groups. This may be related to the optimal surgical condition associated with dexmedetomedine use in the form of less bleeding, more hemodynamic stability and extended analgesia after surgery [21, 32].

5. Conclusion

In conclusion, supplementation of local anesthesia with dexmedetomidine produces an adequate level of intraoperative hemodynamic stability, conscious sedation, adequate analgesia, low postoperative analgesic requirements with extended pain free period and less bleeding in all patients. These effects are well obtained with high dose of dexmedetomedine.

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