HEMODYNAMIC EFFECTS OF DEXMEDETOMIDINE--FENTANYL VS. NALBUPHINE--PROPOFOL IN PLASTIC SURGERY

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Abstract

Dexmedetomidine has demonstrated to be useful in several clinical fields due to its respiratory safety and cardiovascular stability. We undertook this study to determine its usefulness in plastic surgery. Sixty patients were divided into two parallel groups. A group received dexmedetomidine--fentanyl and the comparison group received nalbuphine--propofol, both with same dose of midazolam. Blood pressure, heart rate and oxygen saturation were determined during the preoperative, intraoperative and recuperation periods. Results. In both groups, hemodynamic constants decreased intraoperatively. Dexmedetomidine--fentanyl decreased more than in the nalbuphine--propofol (systolic blood pressure, $p = 0.006$; diastolic blood pressure, $p = 0.01$ and heart rate, $p = 0.007$). Comparatively, oxygen saturation was greater in the dexmedetomidine--fentanyl group vs. nalbuphine--propofol ($p = 0.0001$). Recovery time for the nalbuphine--propofol group was shorter than in the dexmedetomidine--fentanyl group ($p = 0.0001$). Conclusions. Dexmedetomidine shows the same cardiovascular stability but with absence of respiratory depression.

Key words: Dexmedetomidine, Plastic surgery, Respiratory distress, Cardiovascular stability.

Introduction

Analgesic sedation along with local anesthesia has demonstrated efficacy for minimizing costs, reducing hospital stay and decreasing risks due to general anesthesia in multiple aesthetic procedures. The aim is to eliminate infiltrative procedures, decrease pain and anxiety and improve patient mobility by providing a state of reduced consciousness and mild amnesia. Different drugs with different formulations, routes of administration, dosing and multiple combinations are available to achieve the desired type and depth of sedation[1,2].

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Recently, dexmedetomidine, an α_2 agonist with sedative and analgesic properties, has been tested in the U.S. for sedation in the intensive care unit (ICU). Its safety and efficacy has been widely proven in multiple procedures[3].

Dexmedetomidine compared with propofol in ICU postoperative patients has demonstrated a suitable pharmacodynamic profile with better psychomotor recovery. It preserves an appropriate residual analgesic control and synergism with other analgesic drugs that decreases the need for complementary opioid analgesics. Dexmedetomidine also shows ability to attenuate stress responses during surgery due to its sympatholytic properties[4-6].

Additionally, dexmedetomidine is also useful as sedation free of adverse events in postoperative monitored patients in ICU, with lower maintenance dose[6]. Trials have been conducted in surgical procedures with dexmedetomidine[7,8].

Dexmedetomidine has not been studied in plastic surgery. The aim of our study was to compare the hemodynamic effects of dexmedetomidine--fentanyl vs. nalbuphine--propofol in these procedures.

Materials and Methods

Approval was obtained from the local ethics committee and from the participating hospital. Written informed consent was obtained from all patients. Sixty patients were selected for plastic surgery. All patients underwent physical examination and clinical history, with ASA classification I-. All patients denied coagulation problems.

The aim was to demonstrate the hemodynamic effects of dexmedetomidine--fentanyl vs. nalbuphine--propofol in plastic surgery. Sample size consisted of 60 patients distributed in two groups: one group was administered dexmedetomidine--fentanyl (n = 30) and another group was administered nalbuphine--propofol (n = 30), both with the same dose of midazolam. All patients were >40 years of age and with a Goldman classification I. Exclusion criteria were patients with heart failure, coronary disease, renal failure, liver failure, severe obesity or chronic pulmonary illness.

All patients were admitted to the hospital at 7:00 a.m. after a 10-h overnight fast. On arrival, an intravenous (IV) line was established to administer Ringer lactate solution. Subjects were randomized in open groups to receive dexmedetomidine--fentanyl or nalbuphine--propofol. Drug dosings for analgesic sedation were adjusted for each patient according to body weight.

Before sedation, patients were monitored with a derivation-II electrocardiogram (ECG), pulse wave plethysmography, pulse oximetry and blood pressure with an intermittent pneumatic system. The following variables were recorded at baseline, every 5 min during surgery and postoperatively: ECG, oxygen saturation (O_2 sat), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial blood pressure (MAP). Sedation was performed as follows.

Dexmedetomidine--Fentanyl Group

There was an initial loading dose of midazolam (20 µg/kg), continuing with a dose of fentanyl (1 µg/kg) in a bolus injection followed by a continuous maintenance infusion of 0.5 µg/kg/h until surgery was completed. Finally, a loading dose of dexmedetomidine was added prior to surgery (1 µg/kg) for 10 to 20 min observing sedation effect, followed by a maintenance infusion rate of 0.5 µg/kg/h. Ampoules of 200 µg were diluted in 98 cc of normal saline.

Nalbuphine--Propofol Group

Initial loading dose of midazolam was 20 µg/kg, continuing with a single dose of nalbuphine (50 µg/kg) and, subsequently, propofol in bolus injections (2 mg/kg).

To establish level of sedation, Ramsay sedation score was measured during the postoperative period[9].

All surgical procedures were performed by the same team of plastic surgeons in the participating hospital, and in all cases patients were supervised according to the guidelines for patient safety in crisis situations[10].

Data are presented as mean ± SD. To observe distribution of the results, Kolmogorov-Smirnov test was performed, with a normal distribution. Within-group differences were evaluated with Student's t-test for related samples, and for differences between groups independent Student's t-test was performed. Significance was set at $p \leq 0.05$.

Results

Age and weight for both groups are described in Table 1. Rhytidoplasty was the most common procedure performed in both groups (Table 2). There is no difference between groups in regard to surgical time (data not shown).

Table 1
Clinical characteristics of both groups

	Dexmedetomidine n = 30	Propofol n = 30	P
Age (years)	54 ± 8	53 ± 5	0.05
Weight (Kg)	62 ± 10	67 ± 8	NS

Table 2
Types of surgery in study groups

Study group	Type of surgery	Frequency (%)
Dexmedetomidine n = 30	Rhytidoplasty	75
	Blepharoplasty	20
	Hair implant	5
Propofol n = 30	Rhytidoplasty	85
	Blepharoplasty	15

Hemodynamic Function in the Dexmedetomidine--Fentanyl Group

SBP decreased during surgery (134 ± 18 vs. 103 ± 16 mmHg, p = 0.0001) and postoperatively (100 ± 22 mmHg, p = 0.0001). DBP (82 ± 10) decreased to 60 ± 10 mmHg (p = 0.0001) and postoperatively preserved at 60 ± 10 mmHg (p = 0.0001). Transoperative HR decreased from 74 ± 16 to 63 ± 7 beats per minute (bpm) (*P* = 0.0001) and 64 ± 7 bpm postoperatively (p = 0.001).

In regard to respiratory function, the dexmedetomidine--fentanyl group increased O_2 sat (96.6 ± 3.1 vs. 97.6 ± 2.7%, p = 0.0001).

Hemodynamic Function in the Nalbuphine--Propofol Group

SBP in the transoperative period decreased from 123 ± 13 to 114 ± 14 mmHg (p = 0.016) and 117 ± 15 (p = 0.083) postoperatively. DBP decreased from 74 ± 12 to 67 ± 11 mmHg transoperatively (*P* = 0.044) and postoperatively decreased from 69 ± 11 mmHg (p = 0.083). HR increased transoperatively from 78 ± 13 to 84 ± 13 bpm (p = 0.030) and postoperatively was 85 ± 15 bpm (p = 0.02). O_2 sat did not increase significantly (96 ± 1.7 to 96.5 ± 1%; p = 0.114).

When both groups were compared, in regard to hemodynamic behavior SBP, DBP and HR decreased at baseline, transoperatively and postoperatively (Table 3).

Comparatively, intraoperative O_2 sat was greater in the dexmedetomidine--fentanyl group vs.

Table 3
Hemodynamic behavior in study groups

Systolic blood pressure (mm Hg)	Dexmedetomidine n=30	Propofol n=30	p
Baseline	134 ± 18	123 ± 13	0.01
Intraoperative	103 ± 16	114 ± 14	0.006
Postoperative	100 ± 22	117 ± 15	0.001
Diastolic blood pressure (mmHg)	**Dexmedetomidine**	**Propofol**	**p**
Baseline	82 ± 10	74 ± 12	0.04
Intraoperative	60 ± 10	67 ± 11	0.01
Postoperative	60 ± 10	69 ± 11	0.002
Heart rate (beat/minute)			
Baseline	74 ± 16	78 ± 13	NS
Intraoperative	63 ± 7	84 ± 13	0.007
Postoperative	64 ± 7	85 ± 15	0.0001

Table 4
Difference between groups in respiratory function and time for recovery from sedative effect

Variable	Dexmedetomidine n = 30	Propofol n = 30	P
O_2 Sat (%)			
Intraoperative	97.5 ± 1.3	94.5 ± 2.3	0.0001
Postoperative	97.6 ± 1.4	96.5 ± 1.1	0.001
Time for recovery (minutes)	23.8 ± 0.5	11.3 ± 4.3	0.004
Ramsay (score)	3 ± 0.4	1.9 ± 0.7	0.0001

O_2 sat, oxygen saturation.

nalbuphine--propofol (p = 0.0001). Recovery time in the nalbuphine--propofol group was shorter than in the dexmedetomidine--fentanyl group (p = 0.0001) (Table 4).

Discussion

Adverse events are present in 2.3% of all analgesic sedation procedures. The most frequent event is respiratory depression that, if untreated, may lead to serious outcomes[11]. Our results demonstrate that dexmedetomidine is an effective, safe and useful agent for sedation in plastic surgery due to its analgesic properties and adequate cardiovascular stability, as well as being devoid of respiratory depressant effects. Our results are similar to previous trials where dexmedetomidine has been used for sedation in the ICU[4-6].

In other study, dexmedetomidine was compared with midazolam in ophthalmic surgeries; nevertheless, results are contradictory. Alhashemi[8] reported that compared with midazolam, dexmedetomidine group was accompanied by relative cardiovascular depression and delayed recovery room discharge in patients undergoing cataract surgery. Meanwhile, Abdalla et al.[7] assessed efficacy and safety as adjuvant to local analgesia in ophthalmic surgery; dexmedetomidine decreased intraocular pressure, provided safe control of HR and blood pressure during ophthalmic surgery under local anesthesia.

Results from these clinical trials cannot be compared with our results because only the sedative effect is present in the midazolam groups unlike the hypnotic/analgesic effects that dexmedetomidine provides, an effect that is required for plastic surgery procedures[7,8,10]. Some authors have recently considered propofol combined with another narcotic drug as the gold standard for sedative/analgesic procedures[1,2,10,12].

In both of our groups, dexmedetomidine and propofol were considered equal although the propofol dose was adjusted according to the Ramsay score[13].

Our results show that dexmedetomidine is suitable for plastic surgery according to respiratory and cardiovascular safety, similar to previous reports in other types of surgical procedures where dexmedetomidine was used[4-10,14].

One limitation of our study may be that the study design was based on the Ramsay score rather than an objective measure such as the bispectral index (BIS), a parameter that correlates with the sedative/hypnotic actions of anesthetic drugs[15].

In summary, our results show that dexmedetomidine--fentanyl was superior to nalbuphine--propofol because it was devoid of respiratory depressant effects and decreased the frequency of the use of other anesthetic agents.

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