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Comparison of Remifentanil and Alfentanil Effects on the Hemodynamic Responses to Induction of Anesthesia and Tracheal Intubation in Elderly Patients

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Abstract: Since laryngoscopy and tracheal intubation may result in hemodynamic responses in the form of increasing blood pressure and heart rate and also lead to arrhythmia and myocardial ischemia in the susceptible individuals and these changes can be even harmful for elder people. The present study was conducted to compare Alfentanil and during anesthesia induction and tracheal intubation in the elderly. Forty patients were randomly allocated in two groups in this double blind randomized clinical trial candidates for cataract surgery and received the general anesthesia. Before the anesthesia induction 10 μg kg^{-1} Alfentanil and 0.5 μg kg^{-1} Remifentanil were injected respectively in the first and second groups within 30 sec. Both groups received similar general anesthesia and 1 μg kg^{-1} Alfentanil and 0.1 μg kg^{-1} Remifentanil were, respectively infused in the first and second groups during anesthesia. Heart rates, systolic blood pressure, diastolic blood pressure and mean arterial pressure of the patients were regularly measured and recorded in different stages: before anesthesia induction, after drugs injection, after tracheal intubation and after at 2, 4, 6, 8 and 10 min later. The data were analyzed using the discriptive and analytic statistics in SPSS statistic software in the form of statistic-T test and chi square. After injection of the initial dose of the narcotics, immediately a remarkable decline was found in hemodynamic variables. But decreaser diastolic blood pressure in Remifentanil group was significantly more than in Alfentanil group ($p<0.05$). After laryngoscopy and tracheal intubation, all of the hemodynamic variables increased and returned to the basic value shortly. The decrease in Remifentanil group was significantly higher than in Alfentanil group ($p<0.05$) in the case of systolic blood pressure, diastolic blood pressure and the mean arterial pressure. There was no significant difference between two groups in the case of decrease in the heart rate after tracheal intubation ($p>0.05$). Morever the dose of ephedrine which is used to compensate the sever hypotension in Remifentanil group was significantly more (11 patients) than in Alfentanil group (4 patients) ($p<0.05$). According to the results of this study, we conclude that Remifentanil more than Alfentanil modifies the increase in the blood pressure resulted from laryngoscopy and tracheal intubation, but it produces more reduction in blood pressure during anesthesia. There was no significant difference between both drugs in the case of increase in heart rate after laryngoscopy and tracheal intubation.

Key words: Alfentanil, Remifentanil, hemodynamic, laryngoscopy, tracheal intubation

INTRODUCTION

The cardiovascular responses due to laryngoscopy and tracheal intubation have been well investigated. These responses include increasing of blood pressure and heart rate, dysrrhythmia, cathecholamie release, myocardial ischemia and increasing of oxygen demands of heart (Habibi *et al*., 2002). They may produce complication especially in cardiovascular patients (Kovac *et al*., 1996). Narcotics (Crawford *et al*., 1987), vasodilators (Balakrisnan *et al*., 2000), Betablockers (Vucevic *et al*., 1992), calcium channel blockers (Kovac *et al*., 1996), volatile anesthetics (Bedford and Marshal, 1984), local anesthetics (Stoelting, 1978), alpha blockers (Curran *et al*., 1980) and benzodiazepines can be used to blunt of cardiovascular responses.

Old people require surgical treatment more than others, this group of people always have low physiologic reserves, variability in autonomic performance, a high cardiovascular diseases rate and high sensitivity to the narcotic and anesthetic drugs. These factors can intensify the cardiovascular disorders during anesthesia induction and may cause some problem such as myocardial ischemia, CVA, dysrrhythmia, or sudden death

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in elderly patients (Habibi *et al*., 2002). The narcotics are usually used better tolerance of laryngoscopy and tracheal intubation before surgery. Alfentanil and Remifentanil have been increasingly used because of their rapid effects compared to other narcotics (Weasten *et al*., 2001). Due to the importance of hemodynamic changes in the quality of anesthesia and the health of patients especially in the elderly people, this study was carried to compare the patients cardiovascular responses to the anesthesia induction and tracheal intubation in the elderly people following the administration of Alfentanil and Remifentanil.

MATERIALS AND METHODS

Study design and population: Forty cataract patients who had admitted for surgical treatment were recruited from Ardebil's Alavi hospital located in the North west of Iran. Subjects were patients with ASA (American Society of Anesthesiologist) physical class I-III aged 65-85. The patients with ASA physical class above III, hiatal hernia or gastroesophageal reflux, obese, having history of recent MI and previouse ansthesia problem were excluded. Subjects were interviewed using an interviewer-administered questionnaire. Eligible subjects were randomized to receive 10 μg kg^{-1} Alfentanil (group A) and 0.5 μg kg^{-1} Remifentanil (group R) received within 30 sec. Immediately after receiving primary dose of narcotics, 0.5 mg kg^{-1} propofol followed by 10 mg sec^{-1} was injected in all patients. Until decreasing verbal responses. Finally 1.5 mg kg^{-1} succinylcholine was injected. In next step of anesthesia were induced, using 0.6% halothane and 50% O_2 with 50% N_2O. To keep the muscle weakness, 10-20 mg atracurium was injected. Alfentanil 1 μg/kg/min and Remifentanil 0.1 μg/kg/min were infused during the anesthesia to the patients in groups (A) and (R), respectively. The patients were monitored through pulseoxymetry, NIBP (Non Invasive Blood Pressure) and electrocardiography during anesthesia. The heart rate, systolic and diastolic blood pressures and mean arterial pressure of the patients were all measured and recorded in the patients in different stages: Before the anesthesia, after the injection, after tracheal intubation and within 2, 4, 6, 8 and 10 min by an anesthetist who were blind about injected narcotics. Incremental doses of ephedrine (5 mg) and atropine (0.5 mg) were administered in hypotension (lower than 80 mmHg systolic blood pressure or up to 30% decrease in baseline BP for 60 sec) and for bradycardia (less than 45 heart rate per minute), respectively.

Statistical analysis: Results are expressed as mean±SD.The data were analyzed by using Independent Samples-T test and Chi-square. Significance was assumed at $p<0.05$.

RESULTS

A total of 40 patients were randomly allocated in 2 groups of A (Alfentanil) and R (Remifentanil). All subject underwent similar surgical procedure for cataract. Baseline characteristics of two groups are shown in Table 1. As seen in this table there were not significant difference between 2 groups in the terms of age, gender, mean systolic blood pressure, mean diastolic blood pressure, mean arterial pressure and the mean heart rates of the patients in 2 groups before the anesthesia (Table 1).

Immediately after injection of the initial dose of narcotics the systolic and diastolic blood pressure and the mean arterial pressure and heart rate were significantly decreased in both groups ($p<0.05$). However, diastolic blood pressure were significantly decreased in group (R) more than group (A) ($p<0.05$) (Table 2). After tracheal intubation, all the mentioned variables were increased. The systolic blood pressure returned to the basic value (before tracheal intubation) in both group after 2 min. However, hypotension occured in group (R) significantly more than group (A) ($p<0.05$) at 6th min after tracheal intubation. Diastolic and mean arterial pressure were significantly decreased in group R more than group A from the second minute after tracheal intubation ($p<0.05$). After tracheal intubation, the heart rate in group A became normal at 8th min while this was 6 min in R group. However, there was no significant difference between 2 groups in the case of decreasing in the heart rate ($p>0.05$). (Table 2).

During the anesthesia period, 4 patients in group A and 11 patients in group R need to be administered ephedrine because of hypotension. The difference between two drugs was significant and group A needed to the Ephedrine more frequently than R ($p<0.05$). Mean while, 5 patients in group A and 6 patients in group R needed to use Atropine because decrease in heart rate. There was no significant difference between to drugs here ($p>0.05$) (Table 3).

Table 1: Baseline characteristics of participants

Variable	Group A (X±SD)	Group R (X±SD)	p value
Age	70±5.3	73±6.4	0.37
Gender (female/male)	8/12	9/11	0.26
Systolic blood pressure	146.5±27.5	137.7±30.1	0.34
Diastolic blood pressure	85.7±14.8	77.5±19.7	0.14
Mean arterial pressure	105.9±18.5	97.5±21.8	0.20
Heart rate	68.4±14.7	70.8±13.6	0.59

A = Alfentanil, R = Remifentanil

Table 2: Hemodynamic variables changes in two groups and kind of interference

Measurement time	Group (X±SD)	Systolic blood pressure (X±SD)	p value	Diastolic blood pressure (X±SD)	p value	Mean arterial pressure (X±SD)	p value	Heart rate (X±SD)	p value
Before anesthesia	A	146.5±27.5	0.34	85.7±14.8	0.14	105.9±18.5	0.2	68.4±14.7	0.59
	R	137.7±30.1		77.5±19.7		97.5±22.8		70.8±13.6	
After injection of drugs	A	105.5±27.8	0.17	69.5±14.9	0.04	81.4±18.5	0.26	64.7±10.9	0.27
	R	94.2±23.3		60.2±13.1		74.8±18.3		69.1±14	
After tracheal intubation	A	116.7±33.9	0.41	76.7±19.8	0.1	90.0±24.0	0.48	71.9±11.8	0.24
	R	107.7±35.0		66.2±20.2		84.0±29.1		77.0±15.0	
2 min later	A	102.7±32.1	0.11	70.7±18.6	0.01	81.3±22.6	0.03	66.7±10.6	0.22
	R	88.2±23.3		57.0±14.9		67.3±16.7		72.2±16.6	
4 min later	A	100.2±27.3	0.12	69.2±16.9	0.02	79.5±19.9	0.09	66.6±11.4	0.46
	R	86.2±29.5		56.5±16.7		68.7±19.7		69.6±13.9	
6 min later	A	107.5±24.6	0.002	76.0±15.9	0.000	86.8±18.3	0.000	69.8±9.7	0.41
	R	81.2±25.3		53.7±13.7		62.8±16.9		67.0±11.2	
8 min later	A	108.0±25.2	0.001	77.2±17.3	0.000	87.4±19.5	0.000	63.9±8.8	0.26
	R	81.0±24.3		54.2±13.7		63.1±16.6		70.5±24.4	
10 min later	A	104.0±21.5	0.003	72.5±17.2	0.000	82.9±18.2	0.001	63.8±8.3	0.39
	R	82.0±22.9		54.2±11.8		63.4±14.8		66.0±14	

A = Alfentanil, R = Remifentanil

Table 3: Comparison of two groups needing to injection of Efedrine and Atropine

Additional drug	Group A	Group R	p value
Ephedrine	4	11	0.019
Atropine	5	6	0.20
Without need to drug	11	3	0.015

A = Alfentanil, R = Remifentanil

DISCUSSION

In this study, we compared the hemodynamic changes between two groups of the elderly patients after administering Alfentanil and Remifentanil. There was no significant difference between two groups in systolic and diastolic blood pressures, mean arterial pressure and heart rate. Immediately after injection of initial dose of narcotics, the hemodynamic variables decreased significantly. Diastolic blood pressure was significantly lower in group R more than group. Habibi *et al.* (2002) reported that the systolic blood pressure and mean arterial pressure in both group were decreased after the anesthesia induction and increased 3 min later. However, diastolic blood pressure in group Alfentanil was significantly higher than in group Remifentanil, which is in accordance with our findings.

In this study, after tracheal intubation, all hemodynamic variables were increased, but for the next minutes the systolic, diastolic and mean arterial pressure were decreased. This decrement was significantly higher in Remifentanil than in Alfentanil. Schutller *et al.* (1997) observed that blood pressure decreased in Remifentanil groups more than Alfentanil group. Morever, in the study of Nilsson *et al.* (2003) Remifentanil group showed a higher systolic blood pressure decrement during anesthesia than other group, which is compatible with our findings. Agnew *et al.* (2003) found that Remifentanil had a better hemodynamic stability than Alfentanil.Similar result was found by Sney *et al.* (1998) when they compared Fentanil, Alfentanil and Remifentanil in craniotomy. In the study of Wiel *et al.* (2003) the mean arterial pressure increased 6% in Remifentanil and 20% in Alfentanil groups. This increase returned to the basic levels in Remifentanil group, but it remained high in Alfentanil group. In this study, the patients in both groups showed an increase in the heart rate after tracheal intubation, which became normal shortly. Two group were not significantly different in the heart rate change. Although this is in contrast with finding of Schutller *et al.* (1997) which showed that bradycardia may occur in Alfentanil more than Remifentanil, other studies have reported similar result in the heart rate change. Ephedrine as sympathomimetic was administered in 11 patients under Remifentanil and 4 under Alfentanil. This shows that hypotension could occur in Remifentanil group more frequently than Alfentanil. This findings supports those of Schutller *et al.* (1997) and Nilsson *et al.* (2003) study.

CONCLUSION

In this study, it was found that Remifentanil can blunt hypertension caused by the laryngoscopy and tracheal intubation better than Alfentanil and induce a higher hypotension during anesthesia. But there is no significant difference between two drugs regarding the increase in heart rate after laryngoscopy and tracheal intubation.

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