Original Article

THE EFFECT OF INTRAMUSCULAR EPHEDRINE IN PREVENTION OF HYPOTENSION DUE TO PROPOFOL

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ABSTRACT

Objective: To evaluate the effect of intramuscular (IM) ephedrine before injection of propofol, to reduce hypotension.

Methodology: It was a prospective, hospital based study conducted during March 2003 to December 2003, at Nikookary Hospital, Tabriz Medical Science University, Iran.

This study was performed on one hundred patients who were candidates for elective ophthalmic surgeries randomized to two groups of 50 patients. In one group (group A) ephedrine 10mg (2cc) and in other group (group B) sterile water 2cc were injected intramuscularly. Twenty minutes before induction of anesthesia or before injection of propofol, during intubation, in 1st, 4th, 7th and 10th minutes of anesthesia blood pressure and heart rate were measured in both groups. The mean values were compared in two groups.

Results: There was only one case with significant mean diastolic blood pressure drop at 1st minute after intubation in group A comparing with group B. P=0.001. In other cases, differences of mean blood pressures were not significant. Also heart rates in all mentioned minutes were significantly higher in group A than group B. P<0.05)

Conclusion: IM injection of ephedrine before induction of anaesthesia with propofol does not have any significant effect in decreasing of patient's hypotension during operation, however it increases their heart rates. According to the potential hazards of the later complication, especially in old patients, this procedure is not recommended.

KEY WORDS: Propofol, Prophylactic Ephedrine, Intramuscular, Hypotension.

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INTRODUCTION

Introduction of sodium thiopental to the medicine in 1935 resulted in a new way of anaesthesia by use of intravenous drugs. Sodium thiopental and other barbithorates are not ideal drugs because they cause only hypnosis, they have long recovery and they are anti–analgesic so, many studies were performed to find a suitable alternative drug, one of them was propofol.

In the study by Kay and Rolly in 1977, propofol was introduced as a strong anaesthetic drug and nowadays is one of the most common drugs used in the induction of anaesthesia. Need for Rapid recovery, prevention of post Operative Nausea and Vomiting (PONV) and Intra Ophthalmic Pressure (IOP) elevation

are three important concerns associated with ophthalmic surgeries.[1]

As propofol has rapid recovery and has potency to decrease PONV and IOP it has become as a suitable drug in ophthalmic surgeries.

The most important complication of this drug is hypotension, which is dose – dependent. It is frequently seen when the drug is used in high doses during induction of anesthesia. (2.5mg/kg). 2-2.5mg/kg propofol causes systolic hypotension in 25-40% of cases.[1] Appropriate dose of propofol for producing adequate depth for induction of anesthesia is 1-2.5mg/kg. We used 2mg/kg in this trial which caused systolic hypotension in almost 25% of cases.

The same changes are also seen in diastolic blood pressure and mean arterial blood pressure.

This hypotension is associated with decrease of cardiac index (15%) systemic vascular resistance (15-25%) stroke volume (20%), left ventricular stroke work index (30%). Decrease of systemic blood pressure after bolus injection of propofol is depended to both vasodilation and myocardial depression.

Heart rate doesn't significantly change after bolus of propofol which is due to its inhibitory effect on baroreflexes so; it decreases the reflex tachycardia following hypotension. There are different ways to treat hypotension such as volume loading, slow incremental injection of the drug and intravenous injection of ephedrine as soon as hypotension occurres.[1,2] Ephedrine is a common drug for treatment of hypotension with propofol. IV injection because it is not possible to achieve rapid responses in IM form Of course blood pressure decline during operation has many harmful consequences as mentioned above.[3,4] For this reason prophylactic administration of ephedrine prior to induction of anesthesia is advantageous in order to prevent hypotension during anesthesia and in postoperative period.

Use of prophylactic ephedrine in spinal and epidural anaesthesia has been studied. In this clinical trial, we evaluated the effect of prophylactic IM ephedrine in prevention of hypotension during induction of anaesthesia by propofol.

PATIENTS AND METHODS

After obtaining informed consent and approval from the Ethics Committee of hospital one hundred adult patients (41 to 82 years old) who were in ASA (American Society of Anesthesiologists) class I, II and scheduled for elective ophthalmic surgeries, were enrolled in this double – blinded randomized clinical trial. This study was performed from March 2003 to December 2003 in Nikookary Hospital. Patients with history of cardiac, renal or liver disease and mallampati class 3 or 4 were excluded. Blood pressure, heart rate, Sao2, ECG and ETCO2 (End tidal CO2) were monitored in all patients during operation. All patients received 5-6cc/kg isotonic Normal saline (0.9%) before the induction of anesthesia. Then they were randomized into tow groups of 50. In group A we injected ephedrine 10mg in 2cc volume IM 20 minutes before the induction and in group B sterile water 2cc IM 20 minutes before the induction of anesthesia. Then all patients in the two groups were anaesthetized by propofol 2mg/kg, fentanil 1µg/kg, midazolam 1mg, and atracurium. 2-3mg/kg. Anesthesia was maintained by O2 50%, N2O 50% and halothane 1%.

Baseline heart rate, systolic, diastolic and mean blood pressure before induction, during intubation, and in 1st, 4th, 7th and 10th minutes after induction were measured for each patient. The cases with hypotension, divided to 20% and 30% decrease from baseline, were compared in two groups. Also, the cases with decrease or increase in heart rate, divided to 20% and 30% change from baseline, were compared in two groups. Data were analyzed in SPSS 13 statistical package.

Comparing of categorical data was done by chi – square test or Fisher's exact test. Comparing of quantitative data was done by independent samples T- test. $P< 0.05$ was statistically important.

RESULTS

There wasn't statistical difference in demographic data (age, sex, weight) in two groups (Table-I). In group B in 4 cases (8%) hypotension was seen after induction who needed IV ephedrine. In Group-A 16 cases (32%) experienced hypotension and needed IV ephedrine which was injected as following (Table-II):

* 6 cases (12%) in 4th minute.
* 5 cases (10%) in 10th minute
* 2 cases (4%) in 1st minute.
* 2 cases (4%) in 7th minute.
* 1 case (2%) during intubation.

Comparison of the results of systolic, diastolic and mean blood pressure between two groups showed that only in one case in Group-A (diastolic blood pressure of the 1st minute after intubation), a significant decrease in blood pressure occurred, as compared with Group-B (P=0.001). But in other cases there was not statistical difference between blood pressures (Table-II).

Comparison of BP changes higher than 20% from baseline between two groups showed that except of diastolic hypotension at first minute after itubation in one case.(P=0.01) number of systolic, diastolic and mean hypotension higher than 20% from baseline were significantly more in group B than group A. These include: Systolic BP during intubation (P=0.43) Systolic BP at 4th minute (P=0.027) Systolic BP at 10th minute (P=0.005) and mean BP at 10th minute after intubation. Comparison of BP change higher than 30% from baseline between two group showed there was not any significant difference unless in systolic BP at 4th minute after intubation. (P=0.009). The mean HR changes were significantly higher in group A than group B at all minutes after intubation. (Table-III)

DISCUSSION

Numerous studies have been performed about the use of intramuscular ephedrine before regional anaesthesia (spinal or epidural) and also about use of intravenous ephedrine to prevent hypotension after induction of general anaesthesia by propofol. In this clinical trial, we studied the effect of prophylactic IM ephedrine in general anaesthesia by propofol.

Ozcocak investigated the effect of 60mg/kg IV ephedrine in prevention of hypotension, before induction of general anaesthesia by 2mg/kg propofol and showed that IV ephedrine in low doses before induction of anaesthesia can prevent hypotension due to propofol.[5] Kasaba studied the effect of IV ephedrine 20 minutes before induction and showed that both mean blood pressure and heart rate significantly increased after anaesthesia.[6] Gamlin used IV ephedrine with propofol in patients older than 60 years who were candidates for urogenital surgeries. Although this way prevents hypotension during surgery but at the same time increases their heart rate. That is why he didn't recommend this approach in these groups of patients.[7]

Michelsen used IV ephedrine one minute before injection of propofol which significantly inhibited decrease of blood pressure but did not completely prevent it.[8] In El-Beheiry's study 70mg/kg IV ephedrine before induction of anaesthesia by propofol was not effective in preventing hypotension and also caused tachy-

Table-I: Demographic characteristics and Baseline parameters

	Group A	*Group B*	*P-value*
Age	69.34 ± 8.30*	68.16± 8.75	p>0.05
Weight	61.56 ±10.23	63.04 ±10.42	p>0.05
Gender	Men 25(50%) Women 25(50%)	Men 27(54%) Women 23(46%)	p>0.05
Baseline systolic blood pressure	150.30 ± 23.67	159.16 ± 31.34	0.114
Base line diastolic blood pressure	85.94 ±14.2	85.66 ± 17.10	0.372
Base line mean blood pressure	117.47 ± 22.03	117.85 ± 26.56	0.951

*Mean± standard deviation

Table-II: Blood pressure changes from base line and statistical difference in BP changes between two groups

	Group A	*Group B*	*P-value*
Intubation SBP	121.76 ± 26.92*	115.30 ± 34.95	0.303
Intubation DBP	68.78 ± 18.74	68.66 ±24.28	0.978
Intubation MBP	87.00 ± 28.64	81.58 ±26.31	0.327
1st minute SBP	125.68 ± 27.14	127.80± 32.43	0.724
1st minute DBP	73.88 ± 18.40	92.62± 26.29	0.001
1st minute MBP	92.42 ± 20.19	97.56 ±26.47	0.278
4th minute SBP	116.18 ± 25.86	111.88± 22.93	0.381
4th minute DBP	68.52 ± 16.76	67.76± 16.71	0.827
4th minute MBP	87.56 ± 19.56	83.87 ±19.13	0.489
7th minute SBP	114.70 ± 21.50	106.44 ±21.11	0.055
7th minute DBP	67.92 ± 13.15	63.94 ±14.12	0.148
7th minute MBP	78.84 ± 16.68	78.88 ±15.69	0.990
10th minute SBP	109.82 ± 18.33	105.32± 21.49	0.263
10th minute DBP	64.78 ± 11.06	64.08± 15.16	0.793
10th minute MBP	82.60 ±14.36	79.26± 17.54	0.300

*Mean± standard deviation SBP: Systolic blood pressure
DBP: Diastolic blood pressure MBP: Mean blood pressure

cardia.[9] In another study performed on patients with ASA class I by Gamlin, injection of 15mg IV ephedrine at the same time with propofol was not only effective to maintain blood pressure in the values as before induction but also didn't have significant effect on patient's heart rate.[10] In some other studies the effect of IM ephedrine in prevention of hypotension has been evaluated: Nishikawa showed that low doses of IM ephedrine (1.5mg) in patients older than 60 years reduced occurrence of hypotension in spinal anaesthesia.[11] Di roio and webb showed that intramuscular doses of phedrine (30mg and 37.5 mg respectively) were effective in reducing the occurrence of hypotension in patients undergoing spinal anaesthesia.[12] A similar study done by Rout et al.[13] did not recommend this method because of increasing heart rate. As it is evident some of these studies recommend this method and the others do not which may be due to difference in ideas like:

1. Performing the study on patients with different physiologic status.
2. Two forms of injection (IM or IV).
3. Not being able to identify the definite time of IV or IM injection of drug.
4. Using drugs such as opiates or benzodiazepines for premeditation which increase the effect of propofol.

In our study, there aren't absolute results about effect of prophylactic IM ephedrine in prevention of hypotension due to propofol during general anaesthesia. Heart rate was also significantly higher in group A than group B (Table-III) which were the same as reported by Rout's study.[13]

Table-III: Number and percentage of cases of 20% and 30% change in HR from baseline in group A and statistical difference in mean HR changes between two groups

	20%	*30%*	*P value*
1st minute HR	(16%) 8	(10%) 5	0.012
4th minute HR	(14%) 7	(6%) 3	0.028
7th minute HR	(14%) 7	(4%) 2	0.008
10th minute HR	(24%) 12	(6%) 3	0.005

HR: Heart rate All changes in HR were incremental

CONCLUSIONS

Although there are some positive effects of ephedrine in prevention of hypotension but because of potential hazards of increase in heart rate especially in elderly and seriously ill patients, the use of prophylactic IM ephedrine is not recommended to reduce this complication. However, load of titrated fluid (in old and ill patients), use of propofol in small incremental doses (10-30mg) until loss of consciousness and use of lower doses of propofol (1-1.75mg/kg) in patients older than 60 years is recommended.

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