HEMODYNAMIC VARIATION FOLLOWING INDUCTION AND TRACHEAL INTUBATION

- Thiopental vs Propofol -

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Abstract

Background/Aim: Hemodynamic variations are inevitable during induction of anesthetic drugs. The present study, investigates the hemodynamic variations of two different drugs used for induction; Thiopental *vs*. Propofol.

Materials and Methods: In a prospective randomized double-blind study, from June 2003 to November 2004, 120 (ASA I and II) patients scheduled for elective surgery, were randomly divided into two equal groups. Patients were premedicated with midazolam (0.05 mg/kg) and fentanyl (1 μg/kg). Anesthesia was induced with either thiopental 5 mg/kg (group T) or propofol 2 mg/kg (group P). Neuromuscular blockade was achieved with atracurium (0.5 mg/kg) and anesthesia was maintained with halothane 1%, nitrous oxide (67%) in O_2. Hemodynamic variable (systolic and diastolic blood pressure, mean arterial pressure and heart rate) were measured non-invasively in three periods: before drug administration, immediately after injection, prior to intubation, and finally immediately after intubation.

Results: the incidence of hemodynamic changes in systolic,

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diastolic, mean arterial blood pressures and heart rate were significantly higher in group T compared to group P.

Conclusion: We conclude that Propofol causes less hemodynamic changes compared to Thiopental. Therefore, we recommend Propofol especially when dealing with hemodynamically compromised patients.

Key words: Propofol; Thiopental; general anesthesia; induction; hemodynamic changes; blood pressure; heart rate.

Introduction

Hemodynamic variation, especially hypotension, occurs after intravenous (IV) administration of various anesthetic agents such as thiopental and Propofol[1-3]. Several studies have been performed in order to find anesthetic drugs with least hemodynamic effects. Thiopental has been a popular IV anesthesia agent for many years. However, Propofol, a diisopropylphenol IV hypnotic agent, is gaining popularity because of patients' rapid recovery and its antiemetic properties. Various investigations have been performed on the hemodynamic parameters of these two drugs in order to find the safer drug[4-9].

In the present study, the cardiovascular effects and hemodynamic responses of comparable induction doses of thiopental and Propofol, were examined.

Methods and Materials

After Jahrom University of Medical Sciences Ethics Committee approval, an informed written consent was obtained from 120 (ASA I & II) patient, aged 20 to 50 years, scheduled for elective general surgery for which tracheal intubation was indicated. Exclusion criteria included potential airway difficulty, difficult intubation or intubation duration of more than 60 seconds.

Using open-label randomization, patients were allocated to receive either 5 mg/kg Thiopental (Blechem/e Gesellschaft M.B.H, Vienna, Austria) (group T, n = 60) or IV propofol induction (Liporo, Braun Co.) (Group P, n = 60). In all patient, IV access was established and lactated Ringer's infusion was started. After preoxygenation for two minutes, Midazolam (0.05 mg/kg IV) and fentanyl (1 ug/kg IV) were given to all patients 3 minutes before induction.

Neuromuscular blockade was achieved with atracurium (0.5 mg/kg IV) and anesthesia was maintained with halothane 1%, nitrous oxide (67%) in O_2. Thereafter, patients in each group were managed differently. Less than sixty seconds after hypnotic agent administration, laryngoscopy and intubation were attempted with a Macintosh 3 laryngoscope blade and an 8.0 mm endotracheal tube.

Baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial blood pressure (MAP) before the induction, were recorded Time Zero (HRO). Afterward, HR and noninvasive blood pressure monitoring was done and recorded at, one minute after induction, immediately before intubation (time one) (HR_1) and one minute after intubation (time two) (HR_2). Any untoward hemodynamic effects related to induction and tracheal intubation, were noted.

Monitors included an automated blood pressure cuff, electrocardiogram, peripheral pulse oximeter, and capnometer. Control values of arterial pressures, HR, and peripheral oxygen saturation (SpO_2) were obtained before induction.

Statistical analysis was accomplished using SPSS software (Version 10.07, SPSS, Inc., Chicago, IL. Minimum sample size was estimated using an *a priori* power analysis based on a confidence level of 0.95 and a power of 0.90. Variance of the paired differences was based on previous data. The Student's *t*-test and Mann-Whitney U tests (when appropriate) were used to identify statistical differences between the two groups in patients' demographic characteristics (age, gender, body surface area) ASA physical status, induction time, intubation time and hemodynamic parameters (HR, SBP, DBP and MAP). A repeated measures analysis of variance was used to identify statistical differences in HR, SBP, DBP and MAP between groups. Statistical significance was accepted when $p < 0.05$.

Results

There were no demographic differences between the groups (Table 1) and both groups were similar in age, sex, and ASA physical status. Intubation in all 120 patient was accomplished within 60 seconds. No complication were observed.

Table 1
Demographic characteristic of 120 patients (Group T & Group P)

	Group T (thiopental)	Group P (Propofol)	Significance ($p < 0.05$)
Age (mean)	42 ± 10	38 ± 13	$p = 0.223$
Sex			
Males	32	35	$p = 0.203$
Females	28	25	$p = 0.120$
ASA physical status			
I	31	37	$p = 0.451$
II	29	23	$p = 0.605$

All continuous data are shown as mean ± SD. All nonparametric data are displayed as counts. Statistical significance was accepted when $p < 0.05$.

Heart rate increased significantly from the baseline (time zero; HR_0) in both groups during induction and peaked one minute after intubation ($p < 0.05$) (Figure 1 and Table 2).

Fig. 1
Comparison of systolic and diastolic blood pressures during induction and one minute after intubation (HR_2) thiopental and propofol.

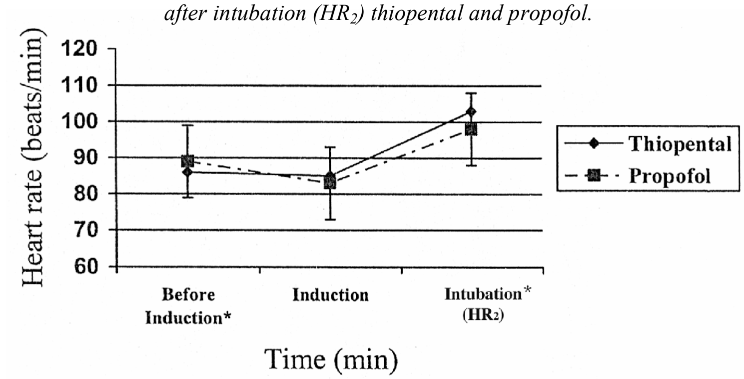

Table 2
Variation in hemodynamic parameters between time zero and one minute after intubation (HR_2) in group T and P.

	Group T (thiopental)	Group P (Propofol)	Significance ($p < 0.05$)
Heart rate (beats/min)	17 (19.7%)	9 (10.1%)	$p = 0.029$
Systolic blood pressure (mmHg)	15 (11.9%)	4 (2.9%)	$p = 0.014$
Diastolic blood pressure (mmHg)	16 (19.5%)	1 (1.1%)	$p = 0.016$
Mean arterial pressure (mmHg)	15 (15.7%)	2 (2%)	$p = 0.020$

Statistical significance was accepted when $p < 0.05$.

However, after intubation, heart rate (HR_2) changed more significantly in group T compared to group P ($p < 0.05$) (Table 2). SBP, DBP and MAP decreased slightly from baseline (SBP_0, DBP_0, and MAP_0) in both groups and afterwards, increased significantly ($p < 0.05$) (Figures 2, 3) (Table 2). Significantly more variations were observed in group T ($p < 0.05$) (Table 2).

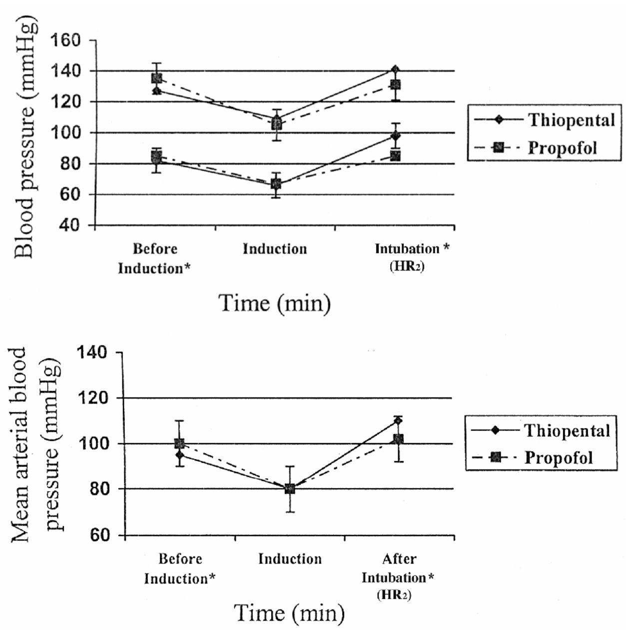

Fig. 2
Comparison of systolic and diastolic blood pressures during induction and one minute after intubation (HR_2) thiopental and propofol.

* Statistically significant ($p < 0.05$).

Discussion

The finding of this study reveal that when compared with thiopental 5 mg/kg. IV, propofol 2 mg/kg causes less hemodynamic variations. The hemodynamic changes associated with anesthetic induction and tracheal intubation are due to the combined effects to the induction drug, the muscle relaxant, laryngoscopy, and intubation.

Results show that tachycardia has developed as compared to baseline (preinduction, time zero) during and after laryngoscopy and tracheal indubation, in both groups (Figure 1). A slight decrease of blood pressure of short duration was also seen in both groups (Figures 2, 3). However, after tracheal intubation blood pressure changed significantly, more in patients receiving thiopental (Figures 2, 3 and Table 2).

Our results suggesting a beneficial effect of propofol on heart rate and blood pressures are consistent with several recent studies. Aono *et al* evaluated and compared the effects of thiopental, propofol and etomidate on hemodynamic, sympathetic outflow and arterial baroreflex sensitivity using not only neuraxis-intact but also totally baro-denervated rabbits. They revealed that thiopental is stronger than propofol in directly suppressing sympathetic outflow at the induction dose[3], therefore, causing less hemodynamic changes. Similar to Aono e*t al,* Mustola *et al* compared the hemodynamic responses to endolaryngeal procedures during anesthesia with propofol or thiopentone in an experimental study in normal patients, instead of rabbits. They also concluded propofol blocks the catecholamine and hemodynamic responses to endolaryngeal procedures more effectively than thiopentone[10]. In a similar study done by Gin *et al* on neonates, propofol attenuated the hypertensive and catecholamine response associated with laryngoscopy and tracheal intubation[11]. Gin *et al.* also obtained similar results to our study in observing that propofol causes less variation in arterial pressure than thiopentone[6]. Vohra and co-workers observed that, although propofol caused decrease in MAP and systemic vascular resistance (SVR) and thiopental did not, the cardiac index and heart rate however, remained unchanged in both groups[12]. In addition to the decreased hemodynamic changes with propofol, it is superior to thiopentone in its more rapid recovery from anesthesia[13].

Brossy and co-workers compared the hemodynamic and catecholamine responses to laryngoscopy and tracheal indubation in 43 patient after induction of anesthesia with either thiopentone 5.1 mg/kg^{-1} or propofol 2.2 mg/kg^{-1}, each with suxamethonium and without opoid pretreatment[4]. They showed that HR increased significantly above baseline after induction and intubation in both groups, but unlike our study in which significant difference between the two groups existed, they observed no differences between the two groups. They concluded that doses of either thiopentone or propofol sufficient to obtund the eyelash reflex with suxamethonium alone, do not adequately block the catecholamine and hypertensive responses to laryngoscopy and intubation in normal patients. Although propofol suppresses increases in catecholamines to a greater extent than thiopentone, there is no clinical advantage. Additionally, unlike our study in which propofol seemed safer than thiopental, Zaballos and co-workers, in an experimental animal model, concluded that propofol is more arrhythmogenic than thiopental as manifested by a longer duration of induced arrhythmias, particularly atrial flutter[2].

In conclusion our results show that IV propofol cause less hemodynamic changes than thiopental and therefore it is a recommended technic.

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References

1. KOLH P, LAMBERMONT B, GHUYSEN A, TCHANA-SATO V, DOGNE JM, D'ORIO V, GERARD P, LARBUISSON R, LIMET R: Comparison of the effects of propofol and pentobarbital on left ventricular adaptation to an increased afterload. *J Cardiovasc Pharmaco*; *44*(3):294-301, 2004.
2. ZABALLOS M, ALMENDRAL J, ANADON MJ, GONZALEZ P, NAVIA J: Comparative effects of thiopental and propofol on atrial vulnerability: electrophysiological study in a porcine model including acute alcoholic intoxication. *Br J Anaesth*; 93(3):414-21. Epub 2004 Jul 09, 2004.
3. AONO H, HIRAKAWA M, UNRUH GK, KINDSCHER JD, GOTO H: Anesthetic induction agents, sympathetic nerve activity and baroreflex sensitivity: a study in rabbits comparing thiopental, propofol and etomidate. *Acta Med Okayama*; 55(4):197-203, 2001.
4. BROSSY MJ, JAMES MF, JANICKI PK: Haemodynamic and catecholamine changes after induction of anaesthesia with either thiopentone or propofol with suxamethonium. *Br J Anaesth*; 72(5):596-8, 1994.
5. BASSIL A, JABBOUR-KHOURY S, BARAKA A: Propofol versus thiopentone for induction of anesthesia in patients undergoing outpatient surgery. *Middle East J Anesthesiol*; 10(3):307-14, 1989.
6. GIN T, GREGORY MA, OH TE: The haemodynamic effects of propofol and thiopentone for induction of caesarean section. *Anaesth Intensive Care*; 18(2):175-9, 1990.
7. AUN CS, SUNG RY, O'MEARA ME, SHORT TG, OH TE: Cardiovascular effects of i.v. induction in children: comparison between propofol and thiopentone. *Br J Anaesth*; 70(6):647-53, 1993.
8. BECK GN, MASTERSON GR, RICHARDS J, BUNTING P: Comparison of intubation following propofol and alfentanil with intubation following thiopentone and suxamethonium. *Anaesthesia*; 48(10):876-80, 1993.
9. TZEN CC, TSAI YJ, CHANG CL: Cardiovascular responses to tracheal intubation after thiopentone or propofol. *Ma Zui Xue Za Zhi*; 28(2):185090, 1990.
10. MUSTOLA ST, BAER GA, METSA-KETELA T, LAIPPALA P: Haemodynamic and plasma catecholamine responses during total intravenous anaesthesia for laryngomicroscopy. Thiopentone compared with propofol. *Anaesthesia*; 50(2):108-13, 1995.
11. GIN T, O'MEARA ME, KAN AF, LEUNG RK, TAN P, YAU G: Plasma catecholamines and neonatal condition after induction of anaesthesia with propofol or thiopentone at caesarean section. *Br J Anaesth*; 70(3):311-6, 1993.
12. VOHRA A, THOMAS AN, HARPER NJ, POLLARD BJ: Non-invasive measurement of cardiac output during induction of anaesthesia and tracheal intubation: thiopentone and propofol compared. *Br J Anaesth*; 67(1):64-8, 1991.
13. KERN C, WEBER A, AURILIO C, FORSTER A: Patient evaluation and comparison of recovery profile between propofol and thiopentone as induction agents in Day Surgery. *Anaesth Intens Care*; 26:156-161, 1998.