

A COMPARISON OF PRESSOR RESPONSE TO INDUCTION & ENDOTRACHEAL INTUBATION WITH THIOPENTONE AND PROPOFOL - PROSPECTIVE, RANDOMISED STUDY

Virendrakumar R Belekar

Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India

E-mail of Corresponding Author: vbelekar@gmail.com

Abstract

Aims And Objectives-To quantify and compare cardiovascular response to direct laryngoscopy and endotracheal intubation using Thiopentone and Propofol.

Material and Methods- 200 patients of ASA (American Society of Anaesthesiology) Grade –I and II between 15-60 years, of either sex scheduled for elective and emergency surgery were selected. Group A received Inj. Thiopentone sodium 5 mg/kg (2.5%) and Group B received Inj. Propofol 2 mg/kg (1%), 100 patients in each group. Pulse rate (PR), systolic and diastolic blood pressure (SBP and DBP), mean arterial pressure (MAP) and rate-pressure product (RPP) were recorded pre and post-induction and post-intubation at 1,3 and 5 min.

Results- At 1 min after laryngoscopy and intubation, PR increased significantly in both the groups. Increase was significantly more in Group A than in Group B. At 3 min after intubation, Increase in PR was significantly greater in Group A than in Group B. At 5 minutes, PR decreased in both the groups, difference being statistically insignificant. SBP, DBP, MAP and RPP decreased significantly after induction and intubation at 1, 3, 5 min in Group B than in Group A.

Conclusion - A single induction dose of propofol attenuates, but does not prevent the pressor response to laryngoscopy and intubation. Propofol provides stable hemodynamic condition during induction, laryngoscopy and endotracheal intubation when compared to thiopentone.

Keywords: Thiopentone, Propofol, Pressor response, Induction, Laryngoscopy, Intubation

1. Introduction

The word "Anaesthesia" is derived from Greek meaning (an "without" and aesthesia "Perception") without feeling. General anaesthesia may be induced by either inhalational or intravenous routes to a major extent. It may be produced by several drugs which depress the central nervous system including sedatives, tranquilizers and hypnotics. The introduction of two thiobarbiturates by "Lundy *et al*" marked the first successful use of intravenous route to produce anaesthesia of rapid onset and short duration¹. One of these, Thiopentone becomes widely accepted. Thiopentone has proved as useful as an intravenous anaesthetic, that it remains the standard drug against which all the recently introduced drugs are compared. But thiopentone had certain limitation for its use in clinical practice like Long- elimination half life, inability to blunt the haemodynamic and sympathetic nervous system responses to laryngoscopy and endotracheal intubation², accumulation on repeated incremental doses or as a continuous infusion. A large array of pharmacological agents was used to attenuate the hemodynamic responses to the laryngoscopy and tracheal intubation. Propofol has emerged as ideal intravenous

anaesthetic agent that can be used to inhibit or attenuate the haemodynamic response to laryngoscopy and endotracheal intubation. Prospective, randomized study was conducted to compare pressor response to induction and endotracheal Intubation with Thiopentone and Propofol in 200 ASA (American Society of Anaesthesiology) Grade I and II patients.

2. Material and Method-

The study was conducted at Dr. V.M. Government Medical College and Shri. Chatrapatti Shivaji Maharaj Sarvopachar Rugnalaya, Solapur. For this study, approval from Hospital Ethical Committee was obtained. 200 patients of American Society of Anaesthesiology Grade –I and II of age group from 15 to 60 years and of either sex scheduled for elective and emergency surgery were selected. Written consent was obtained from the patient. They were randomly divided into two groups, containing 100 patients each. Group A received Inj. Thiopentone sodium 5 mg/kg (2.5%). Group B received Inj. Propofol 2 mg/kg (1%). Patients with history of heart disease, respiratory disease, tuberculosis, epilepsy, shock and other systemic diseases

were excluded. Patients having difficult intubation, or previous history of difficult intubation were excluded. Patients those required more than one attempt for intubation were excluded from the study. All the patients were investigated. Complete blood count and hemogram, bleeding and clotting time, urine examination, blood urea, serum creatinine, liver function tests, blood sugar, electrocardiogram, chest x-ray was done whenever required. Anaesthesia machine, bair circuit, proper size of endotracheal tube, laryngoscope, oxygen supply, anaesthesia drugs and emergency drugs were kept ready. Suction machine was checked and kept ready. In all patients, intravenous line was secured with 18 gauge cannula on dorsum of hand or wrist in operation theatre and all patients received dextrose-normal saline. Monitors like pulse oximeter, ECG monitor, blood pressure were applied to all patients. Patients in both the groups were premedicated with injection glycopyrrolate 0.004 mg/kg, Injection midazolam 0.03 mg/kg and injection pentazocine. 0.3 mg/kg. 15 minutes after premedication, pulse rate, systolic and diastolic blood pressure was recorded as baseline data. All patients were preoxygenated with 100% O₂ for 3 minutes. Group A received injection Thiopentone 5mg/Kg (2.5%) and group B received injection Propofol 2 mg/kg (1%). Injection succinylcholine 2mg/kg was given as muscle relaxant for intubation. Patients lungs were manually ventilated with 100% oxygen before orotracheal intubation was performed. Direct laryngoscopy was performed after 60 seconds by using a macintosh 3 laryngoscope blade and tracheal intubation was accomplished within 15 seconds. After confirming the placement of endotracheal tube, anaesthesia was maintained on oxygen (40%), nitrous oxide (60%) and halothane (0.4 to 0.6%). Muscle relaxation was maintained with injection vecuronium (0.08 mg/kg). Patients were ventilated with bair circuit. All patients were monitored throughout the procedure. Observation were made with respect to following parameters- Pulse Rate (PR), Systolic Arterial Blood

Pressure(SBP) and Diastolic Arterial Blood Pressure(DBP) were noted before induction (15 minutes after premedication), After induction, 1 minute, 3 minutes, 5 minutes after intubation. Mean arterial pressure and Rate-pressure product were be calculated from the obtained values.

Hypertension was defined as a MAP more than 30% of a patient's baseline value, or 130 mm Hg, whichever was greater. Hypotension was defined as a MAP less than 70% of a patient's baseline value, or 65 mm Hg, whichever was less. Tachycardia and bradycardia were defined as a HR greater than 120 beats/minutes and <60 beats/minutes, respectively. The incidence of hypertension, hypotension, tachycardia, and bradycardia was recorded during the study period and compared among the two groups. The incidence of dysrhythmia after intubation was also compared among the two groups.

A dysrhythmia was defined as any ventricular or supraventricular premature beat or any sustained rhythm other than sinus. Ephedrine (3mg increments) was administered for hypotension and atropine, in 300 µg increments, for bradycardia.

At the end of surgery, patients received inj. neostigmine 0.05 mg/kg and inj. glycopyrrolate 0.008 mg/kg for the reversal of residual neuromuscular blockade. Patients were extubated and shifted to recovery room.

3. Statistical Methods: The data obtained from the study were organized and analyzed statistically. 'Z' test was applied to find out significance (p value).

4. Observations and Results

Demographic characteristics (age and sex) and baseline of PR, SBP and DBP were similar in both the groups ($p>0.05$). Group A and B consisted of 51 males and 49 females each. Age distribution is given in **figure 1**

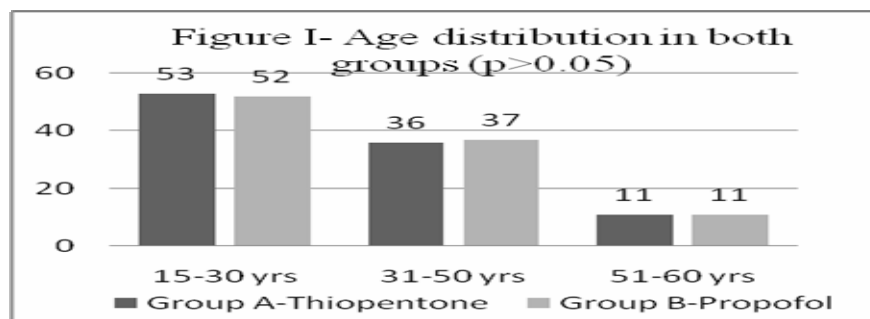
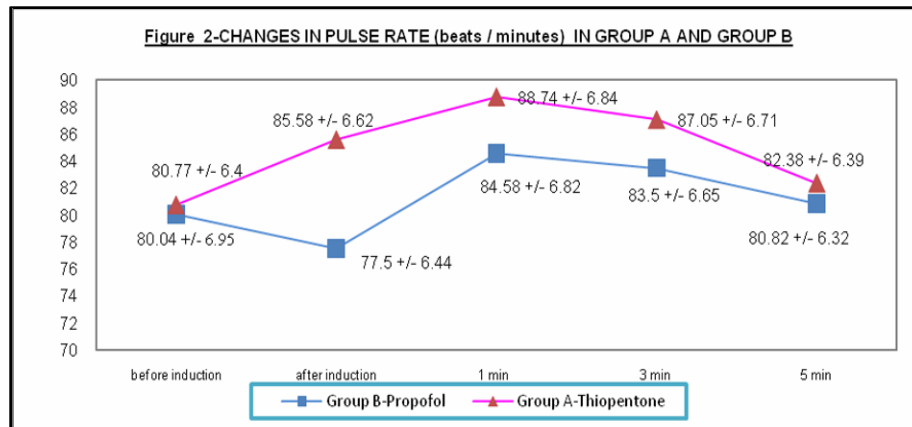


Figure 2 indicates changes in pulse rate in both the groups. There was significant ($p < 0.001$) increase in PR after induction in Group A than Group B. At 1 minutes after laryngoscopy and intubation, PR increased significantly ($p < 0.001$) in both the groups. Increase was significantly more in Group A than in Group B ($p < 0.001$). At 3

minutes after intubation, PR decreased in both the groups. Increase in PR was significantly greater ($p < 0.001$) in Group A than in Group B. At 5 minutes after intubation, PR decreased in both the groups. While comparing Group A with Group B, difference was statistically insignificant ($p > 0.01$).



Changes in SBP, DBP, MAP and RPP (**Figure 3, 4, 5, 6**) showed significant decrease after induction in both the groups ($p < 0.001$), though decrease was more pronounced in Propofol group.

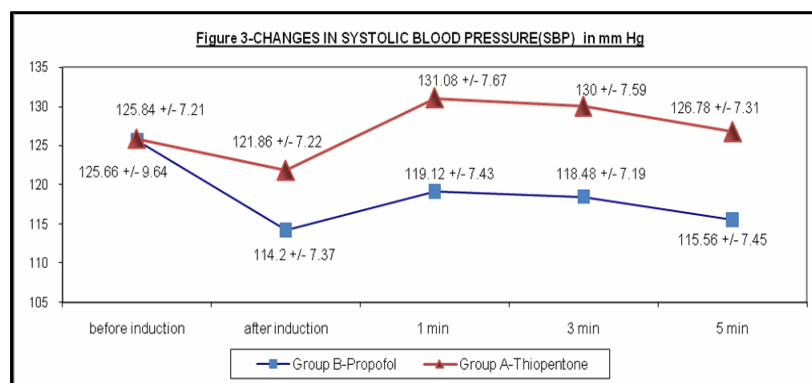
After intubation, SBP, DBP, MAP and RPP increased in group A. It increased above the baseline values significantly ($p < 0.001$) while SBP, DBP, MAP and RPP increased in group B from post-induction values, but remained below the baseline value ($p < 0.001$).

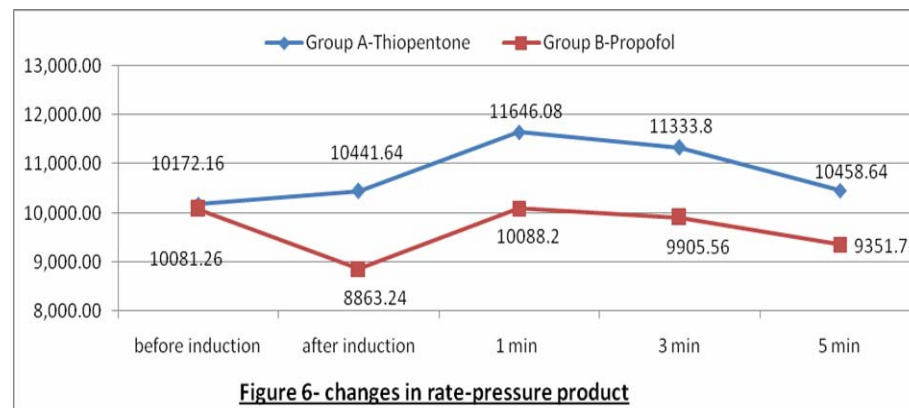
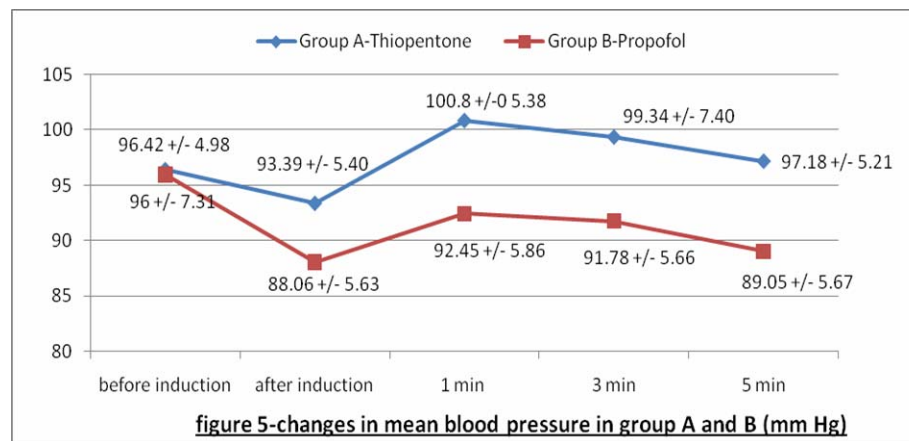
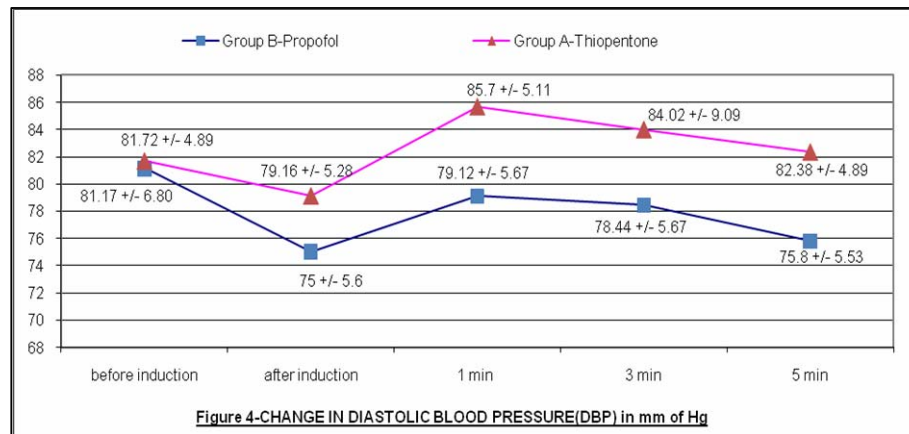
At 3 and 5 minutes after intubation, mean SBP, DBP, MAP and RPP decreased in group A. It remained above than baseline mean values. In group B, mean SBP, DBP, MAP and RPP decreased. It remained below the baseline values at 3 minutes and 5 minutes after intubation respectively.

On comparing Group A and B, SBP, DBP, MAP and RPP decreased significantly ($p < 0.001$) in group B than in group A. At 1, 3 and 5 minutes after intubation, SBP, DBP, MAP and RPP was above the baseline values in group A, while it was below the baseline values in group B. Difference between two groups was significant ($p < 0.001$).

There was no case of bradycardia or hypotension among three groups. No ST segment depression or other electrocardiogram changes was noted in either group. On asking about pain on injection post-operatively to all the patients in both the groups, 12 patients in propofol group complained of pain.

No other side effects were observed.





5. Discussion

The commonest cardiovascular response to laryngoscopy and intubation is an increase in heart rate and arterial blood pressure due to an increase in sympathetic activity³.

Myocardial oxygenation in patients with coronary insufficiency may be severely compromised under these circumstances and may result in ischemic changes and infarction. The present study was set out to compare pressor response during laryngoscopy and intubation following the use of

two commonly used induction agents, Rate Pressure Product is an index of myocardial oxygen Consumption⁴. It is the product of systolic arterial pressure and the heart rate. Increases in heart rate have a marked deleterious effect on myocardial oxygen supply and demand. Rate pressure product exceeding 12,000 is commonly associated with myocardial ischemia and angina. An increase in blood pressure without a change in heart rate appears to be better for myocardial

oxygenation than an increase in heart rate along with the increase in blood pressure.

The present study compared the efficacy of inj. Thiopentone and inj. Propofol for controlling cardiovascular responses to laryngoscopy and tracheal intubation. The results of our study showed that Propofol significantly reduced PR, SBP, DBP, MAP, and RPP after induction and 1,3,5 min after endotracheal intubation as compared to Thiopentone. There were no cases of bradycardia, tachycardia, arrhythmias, ST segment or other ECG changes noted throughout the study. Direct laryngoscopy and endotracheal intubation lead to increasing blood pressure and heart rate⁵. Mechanism of cardiovascular response to intubation is considered to be a reflex sympathetic response to the mechanical stimulation of larynx and trachea. Significant increase in serum levels of norepinephrine and epinephrine subsequent to laryngoscopy with and without tracheal intubation have been described^{6,7}.

Various anesthetic methods and drugs are used for controlling the hemodynamic response to the laryngoscopy and intubation.

N. Mackenzie and I.S. Grant⁸ compared the new emulsion formulations of di-isopropyl phenol (Propofol) with methohexitone and thiopentone for induction of anaesthesia in 60 patients of ASA (American Society of Anaesthesiologist) I or II, undergoing minor urological surgery as a day care surgery. They observed that mean decrease in SBP in the propofol group was 30 mm Hg compared with 18 mm Hg in the other groups and concluded that propofol caused more marked decreases in SBP in the first 2 minutes after induction.

Leonora T. Fahy *et al*⁹ showed that Thiopentone caused little fall in SBP, DBP and MAP while propofol caused a greater decrease, which at 3 minutes after induction caused decrease by mean of over 30 and 20 mm Hg respectively. Fall in diastolic pressure were evident upto 4-6 minutes after injection in propofol group..

G. Rolly and L. Versichelen¹⁰ studied three groups of patients posted for gynecological surgery receiving either 1.5 mg /kg or 2 mg /kg Propofol or 4 mg /kg Thiopentone. They found significant increase in PR, SBP and DBP after 1minute of induction in thiopentone as compared to propofol group. PR, SBP and DBP increased significantly from the baseline value in thiopentone group but decreased significantly to baseline values in propofol group 2 minutes after induction. Pain was not reported during or after the injection.

C.E. Harris *et al*¹¹ studied and compared haemodynamic response to tracheal intubation

receiving either thiopentone 4 mg/kg, etomidate 0.3 mg/kg or propofol 2.5 mg/kg, with and without fentanyl. SBP, DBP decreased significantly after propofol prior to intubation whereas there was significant increase in arterial pressure after intubation after Thiopentone in all three groups. The results were confirmed by S.Coley *et al*¹², C. C. Tzen¹³ and L. Lindgren *et al*¹⁴.

The present study is comparable with the study of N. Mackenzie and I.S. Grant⁸, G. Rolly and L. Versichelen¹⁰, S. Coley *et al*¹², Tzen CC *et al*¹³ and L. Lindgren *et al*¹⁴.

In the present study, mean baseline RPP in both Group A and Group B were comparable and the difference was not significant.

Group A showed significant increase in RPP after induction ($p < 0.01$) from baseline RPP, while Group B showed significant decrease ($p < 0.001$). At 1, 3 and 5 minute after intubation, increase in RPP was highly significant ($p < 0.001$) in Group A. There was insignificant changes in RPP ($p > 0.01$) in Group B at 1 and 3 minutes after intubation, but significant ($p < 0.001$) decrease at 5 minutes after intubation.

All patients were asked about pain on injection post-operatively in both the groups. Pain on injection was noted in 12 patients in Group B. L. P. Briggs *et al*¹⁵ studied Propofol for induction of anaesthesia in doses ranging from 1 to 3 mg/kg for short procedures. Pain on injection occurred in 39% of patients when injected to the back of hand or wrist.

J. S. C. McCollum and J. W. Dundee¹⁶ compared pain on injection at two sites either at antecubital fossa or at dorsum of hand. Thiopentone caused least pain at both sites of injection and propofol caused less pain on antecubital injection than at dorsum of hand.

In present study, incidence of pain on injection was much less than observed by L. P. Briggs *et al*¹⁵. G. Rolly and L. Versichelen¹⁰ observed no pain in their patients.

No other side effects were noted in either group.

Conclusion

Pulse rate was above the baseline after induction in thiopentone group while it was below the baseline in propofol group. After intubation, pulse rate increased in both the groups. It was significantly above the baseline in thiopentone group than in propofol group.

Systolic and diastolic arterial blood pressure, mean arterial pressure and rate pressure product were below the baseline or near the baseline in propofol group after induction and intubation while in thiopentone group, all the values were above the baseline.

Thus, a single induction dose of propofol attenuates, but does not prevent the pressor response to laryngoscopy and intubation. Propofol provides stable hemodynamic condition during induction, laryngoscopy and endotracheal intubation when compared to thiopentone.

References

1. Walter S. Nimmo, David J. Rowbotham and Graham Smith. *Anaesthesia* Volume-1. 2nd Edition.
2. Fischler M, Dubois C, Brodaty D, Schlumberger S, Melchior J C, Guilmet D, Vourc'h G. Circulatory responses to thiopentone and tracheal intubation in patients with coronary artery disease. Effect of pretreatment with labetalol. *Br J Anaesth*. 1985; 57:493-496.
3. Harris, Murray, Anderson, R. M. Grounds and M. Morgan. Effects of thiopentone, etomidate and propofol on the haemodynamic response to tracheal intubation. *Anaesthesia*, 1988; 43:32-36.
4. Javaid A. Zargar, Imtiaz A. Naqash, Showkat. A. Gurcoo, Mehraj-ud-din. Comparative evaluation of the effects of metoprolol and esmolol on rate pressure product and ECG changes during laryngoscopy and endotracheal intubation in controlled hypertensive patients. *Indian Journal of Anaesthesia* .2002; 46:365-368.
5. Stoelting RK. Circulatory changes during direct laryngoscopy and tracheal intubation: influence of duration of laryngoscopy with or without prior lidocaine. *Anesthesiology*. 1977; 47:381-4.
6. Russell WJ, Morris RG, Frewin DB, Drew SE. Changes in plasma catecholamine concentrations during endotracheal intubation. *Br J Anaesth*. 1981; 5:837-9.
7. Bruder N, Ortega D, Granthil C. Consequences and prevention methods of hemodynamic changes during laryngoscopy and intratracheal intubation. *Ann Fr Anesth Reanim*. 1992; 11:57-71.
8. Mackenzie and Grant. Comparison of the new emulsion formulation of Propofol with Methohexitone and Thiopentone for Induction of Anaesthesia in day cases. *Br J Anaesth*. 1985; 57:725-31.
9. Leonora T. Fahy, G. A. Van Mourik and J. E. Utting. A comparison of the induction characteristics of thiopentone and propofol (2, 6-di-isopropyl phenol). *Anaesthesia*. 1985; 40:939-44.
10. G. Rolly, and L. Versichelen. Comparison of propofol and thiopentone for induction of anaesthesia in premedicated patients. *Anaesthesia*. 1985; 40:945-48.
11. Harris, Murray, Anderson, Grounds and Morgan. Effects of thiopentone, etomidate and propofol on the haemodynamic response to tracheal intubation. *Anaesthesia*. 1988; 43:32-36.
12. Coley, Mobley, Bone and Fell. Haemodynamic changes after induction of anaesthesia and tracheal intubation following propofol or thiopentone in patients of ASA grade I and III. *Br J Anaesth*. 1989; 63:423-28.
13. Tzen, Tsai, Chang. Cardiovascular responses to tracheal intubation after thiopentone or Propofol. *Ma Tsui Hsuen Tsa Chi*. 1990; 28:185-90.
14. Lindgren, Yli-Hankala, Randell, Kirvela, Scheinin and Neuvonen. Haemodynamic and catecholamine responses to induction of Anaesthesia and Tracheal Intubation: Comparison between Propofol and Thiopentone. *Br J Anaesth*. 1993; 70:306-10.
15. Briggs, Clarke, Dundee, M. Bahar and Wright. Use of Di-Isopropyl Phenol as Main Agent for Short Procedures. *Br J Anaesth*. 1981; 53:1197.
16. Mc Collum and Dundee. Comparison of induction characteristics of four intravenous anaesthetic agents. *Anaesthesia*. 1986; 41:995-1000.