MJSBH January-June 2013|Vol 12| Issue 1

Induction Characteristics of Propofol in Children: Comparision with Thiopentone.

Sunita Panta[1], Ashok Kamalakar Agashe[2].

[1]Department of Anaesthesiology, Shree Birendra Hospital, [2]Department of Anaesthesiology and Critical care, Armed Forces Medical College

ABSTRACT

Introduction: Induction of anaesthesia has been dominated by intravenous induction agents. The commonest induction agent in use is Sodium Thiopentone. However it is increasingly being replaced by Propofol. The advantage of propofol is faster induction, rapid and clear headed recovery and less postoperative nausea and vomiting. Very little research has been done to compare propofol with thiopentone in children. The aim of this study was to compare the anesthetic effects of thiopentone and propofol in children.

Methods: This prospective comparative study was conducted in 60 consecutive children undergoing elective surgery. The study compared induction characteristics between the two drugs. The aim and objectives was to compare the induction characteristics of 1% propofol with another popular intravenous anesthetic 2.5 % thiopentone.

Results: The study showed that the drugs have similar induction characteristics but there was difference in terms of heart rate, hypotension, apnoea and pain on injection. The heart rate ranged from 103.9 to 107.2 beats per minute in propofol group and for the thiopentone group the changes in heart rate was from 96 to 101 beats per minute. The mean systolic blood pressure in the propofol group was between 91.63 to 97.9 mm of Hg and for thiopentone was between 94.63 and 95.73 mm of Hg. The diastolic blood pressure ranged from 55.5 to 60.23 mm of Hg in the propofol group whereas for thiopentone it ranged between 60.26 to 62.76 mm of Hg. The basal Spo2 being 99.06 in the propofol group dipped to 98.56 in the propofol group and for the thiopentone group the value remained between 98.7 to 99.3%.

Conclusions: Propofol can safely be used as a replacement to thiopentone for pediatric day care surgeries.

Keywords: Children; complications; induction criteria; propofol.

INTRODUCTION

Induction of anaesthesia with the literal meaning of creating hypnosis is a crucial step brought about by various intravenous and inhalational agents. Intravenous agents have the added advantage of being faster as compared to the volatiles. An ideal induction agent should be rapid and pleasant. Intravenous anesthetic agents include Barbiturates, Benzodiazepines, Ketamine, Etomidate and Propofol.

Propofol is a new drug, initially introduced in a Cremopher E_L formulation which had anaphylactoid reactions[1]. Hence Propofol was reformulated in an emulsion form with less allergic reactions[2]. The advantages claimed were short onset of action, rapid and clear headed recovery which is ideal for minor and daycare surgeries where a clear headed and rapid awakening with minimal or no postoperative nausea and vomiting is desirable.[3]

Propofol is still a fairly recent introduction in developing countries. The emergence of paediatric case surgeries has demanded a thorough knowledge of this drug in clinical practice. Hence the comparision of propofol with another popular intravenous induction agent, thiopentone, in paediatric population with special references to the induction characteristics was done.

Correspondence:
Lt. Col. Dr. Sunita Panta
Department of Anaesthesiology, Shree Birendra Hospital.
Kathmandu, Nepal.
Email: sunitapanta@gmail.com

METHODS

This was a prospective randomized control study in 60 children undergoing elective surgical procedures in a tertiary care hospital. After the approval of ethical committee of the hospital, parents/guardians were explained about the research technique and written informed consent was obtained. Patients younger than 5 years and older than 12 years were excluded from study. We also excluded patient with known allergy to egg and ASA grade III and IV.

The children were randomly assigned to receive either propofol or thiopentone for induction of general anaesthesia. They were divided into two groups of 30 patients each. Group A consisted of patients in whom general anaesthesia was induced with propofol and Group B consisted of those in whom general anaesthesia was induced with thiopentone.The results were analysed using Microsoft Excel programme.

Preoperative evaluation was done and the children were admitted a day before surgery. Syrup midazolam (0.5 ml/kg) was given orally 30 minutes prior to induction. In operation Theater, using Collin's monitor and printer, baseline value of BP, heart rate, SpO2 and ECG were recorded. All the children received injection Glycopyrrolate (10mcg/kg) and injection Fentanyl (1 mcg/kg).

After preoxygenation with four to five breaths of 100% Oxygen, induction was started with Propofol for Group A patients and Thiopentone for group B patients injected slowly over 20 seconds in a running drip. Induction time was measured using a stopwatch and judged by loss of verbal contact and eyelash reflex. The dose required to meet the above mentioned end point of induction was recorded. Heart rate, systolic blood pressure, SpO2 and ECG changes were recorded two minutes before induction (basal), during induction (loss of eyelash reflex), two minutes and five minutes after induction. Any adverse effects like pain on injection noticed by the withdrawal of limbs during injection of drugs, apnea and its duration, myoclonus and other signs if present were also noted.

Thereafter the patients were given injection Succinylcholine 2ml/kg intravenously and trachea was intubated. Anaesthesia was maintained with 66% N_2O, O_2 and isoflurane 0.2 to 0.6%. Vecuronium was used for neuromuscular blockade at the dose of 0.1 mg/kg. On completion of surgery, the neuromuscular blockade was reversed with Neostigmine 50 mcg/kg and Glycopyrrolate 10 mcg/kg and the patient was extubated.

RESULTS

The mean induction dose of Propofol was 2.22+/- 0.27 mg/kg and that of Thiopentone was 3.82+/-0.63 mg/kg. The dose of Propofol ranged from 1.82 to 3 mg/kg and that of Thiopentone was between 2.73 to 5.36 mg/kg. The mean induction time for Propofol was 33.43 +/-2.13 seconds whereas for Thiopentone was 33.36 +/-2.28 seconds.

Table 1. Induction dose and time

Parameters	Group A	Group B
Mean Induction dose (mg/kg)	2.22±0.27	3.82±0.63
Mean Induction Time (Seconds)	33.43±2.13	33.36±2.28

The heart rate ranged from 103.9 to 107.2 beats per minute in Propofol group. For Thiopentone group the changes in heart rate was from 96 to 101 beats per minute (Table 2).

The mean systolic blood pressure in the Propofol group was between 91.63 to 97.9 mm of Hg and for Thiopentone was between 94.63 and 95.73 mm of Hg. The diastolic blood pressure ranged from 55.5 to 60.23 mm of Hg in the Propofol group whereas for Thiopentone it ranged between 60.26 to 62.76 mm of Hg.

The basal SPO_2 being 99.06 in the Propofol group dipped to 98.56 in the Propofol group and for the Thiopentone group the value remained between 98.7 to 99.3%.

Among the adverse reactions, pain during injection was only noticed in 16.6% of patients in the Propofol group. Apnoea after injection was seen in both the groups the value bring 73.3% in the Propofol group and 30% in the Thiopentone group. Twitch was only seen in 23.3% of Propofol group.

Table 3. Systolic BP

Parameters	Group A(n=30)				Group B(N=30)			
	T1	T2	T3	T4	T1	T2	T3	T4
Systolic BP (mm Hg)	94.5±6.56	97.9±8.49	92.16±11.06	91.63±8.24	95.16±9.52	95.73±9.4	94.63±9.92	95.3±10.14
Diastolic BP(mmHg)	60.23±6.05	60.13±4.07	54.83±6.93	55.5±5.61	62.4±4.95	62.76±3.79	60.26±4.91	61.8±4.38

Table 4. SpO_2

SpO_2	Group A (n=30)				Group B (N=30)			
	T1	T2	T3	T4	T1	T2	T3	T4
Mean	99.06	99.46	98.56	98.66	98.43	99.13	98.7	99
S D	0.69	0.57	0.97	0.96	0.57	0.68	0.65	0.95

Table 5. Adverse effects

Adverse Reactions	Group A n=30	Group B n=30
Pain on injection	05(16.6%)	0
Apnoea	22 (73.33 %)	09 (30%)
Twitch	07(23.3 %)	0
Laryngospasm	0	0
Allergic reactions	0	0

DISCUSSION

Induction of anaesthesia is a main step in anaesthesia involving the inhalational and intravenous approach. Both the techniques are equally popular in children but recovery is delayed after inhalational approach. This necessitates a search of drug which has a quick onset and offset of action with a shorter recovery period and post-operative side effects.

Thus this study was carried out with the aim and objectives to compare the induction characteristics of 1% Propofol with another popular intravenous anesthetic 2.5 % Thiopentone in children.

The children in both groups were comparable with respect to the demographic and hemodynamic profile. The speeds of injection of drug in the two groups were consistent with the drugs having been administered over duration of twenty seconds. The children in the propofol group required a slightly higher dose as compared to adult in the body weight basis. This could be due to the larger volume of distribution and a higher clearance rate.

There was no statistical difference between the mean induction times with the two drugs. The results are consistent with the findings of Grounds et al who reported a mean induction time of 33.4 seconds for Propofol and Thiopentone respectively[4].

Although the difference in heart rate was not statistically significant, there was bradycardia with Propofol and tachycardia with Thiopentone (Table 2). The central sympatholytic and/or vagotonic mechanism could be responsible for the low heart rate observed despite the decreased arterial pressure in the Propofol group[5]. Propofol either resets or inhibits the baroreceptor mediated reflex. However patients administered Thiopentone showed reflex increase in heart rate due to venodilatation.

The hypotension observed is primarily due to relaxation of vascular smooth muscle and is further compounded by negative inotropic effects of propofol. The observed hypotension probably was lesser due to the compensatory tachycardia seen in the patients induced with Thiopentone. Because of this tendency of both

drugs to cause a marked fall in blood pressure, they should be used cautiously in hypovolaemic patients. And in pediatric patients it mandates a minimal fasting period and preloading prior to induction of anaesthesia with these drugs.

A prominent adverse effect observed during induction of anaesthesia in both these groups was apnoea (Table 6). However with Propofol the occurrence of prolonged apnea was highly significant. Most of the studies have reported apnoea lasting for more than thirty seconds with Propofol, with the incidence ranging from 20% to 83% as compared to 22% to 37% incidence of apnoea with Thiopentone[6,7].

The most commonly reported disadvantage of Propofol is pain at the site of injection. Incidence of pain is reported to be between 28 – 90%[8]. However McCollum discovered no measurable change in the occurrence of pain following the change to the current emulsion formulation containing soybean oil[9]. Klement et al[10] demonstrated that pain on injection is the function of drug itself due to the fat emulsion acting on the endothelium of the blood vessels and changing the composition to long and medium chain triglycerides decreases the incidence of pain. Most studies have also concluded that this incidence of pain could be decreased if larger veins are used for injecting propofol[11]. The activation of the kinin cascade system has been postulated to be the causative factor and pain is a function of the drug itself rather than the formulation. The use of small veins on dorsum of hand is associated with a greater incidence of pain as compared to that occurring with the use of large veins in the ante-cubital fossa. This is consistent with the findings of Edelist[12] and Doze[13] et al. The low incidence of pain in our study could be due to administration of Propofol in a large vein above the wrist in a free flowing intravenous infusion in all our patients.

CONCLUSIONS

Both Propofol and Thiopentone are good intravenous induction agents with comparable induction time and characteristics. Although Propofol causes pain on injection, slight hypotension, it has the advantage of less post-operative nausea and vomiting, no anti-analgesic effect and faster recovery.

REFERENCES

1. *Clarke R. Hypersensitivity to intravenous anaesthetic drugs. Recent advances in anaesthesia and analgesia 14; Churchill Livingstone: pp182.*
2. *Laxenaire MC, Mata Bermejo E, Moneret Vawrin DA. Life threatening anaphylactoid reactions to Propofol. Anaesthesiology. 1992;77;275-80.*
3. *McCollum JSC, Milligan KR, Dundee JW. The antiemetic action of propofol. Anaesthesia. 1988;43:239-40.*
4. *Grounds RM, Twigley AJ, Carli F. The hemodynamic effects of Thiopentone and Propofol. Anaesthesiology. 1985 ;40(8):735-40.*
5. *Sharpe MD, Dobkowski WB, Murkin JM, Klein G, Yee R. Propofol hs no direct effect on sino atrial node function. Anaesthesiology. 1995;82(4):888-95.*
6. *Grounds RM, Maxwell DL, Taylor MB, Aber V, Royston D. Acute ventilatory changes during IV induction of anaesthesia with Thiopentone or Propofol in man. Br J Anaesthesia. 1987;59(9):1098-102.*
7. *Taylor MB, Grounds RM, Dulrooney PD, et al. Ventilatory effects of Propofol during induction of anaesthesia.Comparision with Thiopentone. Anaesthesia. 1986;41(8):816-20.*
8. *McCollum JS, Dundee JW. Comparision of induction characteristics of four intravenous anaesthetic agents. Anaesthesia. 1986;41(10):995-1000.*
9. *McCulloch MJ, Lees NW. Assessment of modification of pain on injection with Profofol.Anaesthesia. 1985;40(11):1117-20.*
10. *Klement W, Arndt JO et al. Pain on injection of Propofol: Effect of concentration and diluent. Br J Anaesth. 1991;67(3):281-4.*
11. *Jones D, Prankerd R, Lang C, Chilvers M, Bignell S, Short T. Propofol – Thiopentone admixture. Hypnotic dose, pain on injection and effects on blood pressure. Anaesth Int care. 1999;27(4):346-56.*
12. *Edelist G. A comparision of Propofol and Thiopentone as induction agents in outpatient surgeries. Can J Anaesth. 1987;34(2):110-6.*
13. *Doze VA, Shafer A, White PF. Propofol- Nitrous Oxide versus Thiopentone –Isoflurane-Nitrous Oxide for general anaesthesia . Anesthesiology. 1988;69(1):63-71.*