INDUCTION CHARACTERISTICS OF TWO DIFFERENT CONCENTRATIONS OF PROPOFOL IN CHILDREN UNDERGOING EYE SURGERIES

Nasreen Laiq, Muhammad Naeem Khan, Shahid Khan, CVM Reddy

Department of Anaesthesia and Department of Ophthalmology,
Hayatabad Medical Complex Peshawar,
Pakistan Institute of Medical Sciences Islamabad, and
L.V Prasad Eye Institute Hyderabad India

ABSTRACT

Objective: *To compare the induction characteristics of two different concentrations of propofol (i.e. 1% and 2%) in children undergoing eye surgeries.*

Material and Methods: *This cross-sectional comparative study was conducted at LV Prasad Eye Institute Hyderabad India. Hundred consecutive patients of American society of Anaesthesiologist (ASA) status I and II coming for elective eye surgeries were enrolled in the study. Patients were divided into two groups of 50 each. Group A were given propofol 1% while patients in Group B were given propofol 2% for induction of anaesthesia and were maintained with 1% isoflurane and 60% nitrous oxide in oxygen. Induction characteristics were assessed and compared in two groups. Student's t test and chi- square test were applied.*

Results: *Loss of consciousness was more rapid with propofol 2% compared with propofol 1% (40s Vs 48s; P = 0.02). Pain on injection occurred in 5 patients (10%) and 10 patients (20%), P = 0.09 after propofol 1% and 2% respectively. Spontaneous movements during induction occurred in 8 patients (16%) and 12 patients (24%, P=0.18). Satisfactory intubation was done in 40 patients (80%) and 45 patients (90%, P=0.19), while spasm just after intubation was noticed in 1 patient (2%) and 3 patients (6%) receiving propofol 1% and 2% respectively. Haemodynamic changes were not different in the two groups.*

Conclusion: *Propofol 1% and propofol 2% are equally effective and safe for induction of anaesthesia in children undergoing eye surgeries.*

Key Words: *Induction, IV Anaesthetics, Propofol, Ophthalmic Procedures, Children.*

INTRODUCTION

Propofol is becoming more popular in ambulatory care areas to facilitate short procedures because it has both the advantage of rapid induction and recovery time[1]. In the operating room, propofol has been used extensively for paediatric anaesthesia with good results in terms of efficacy and safety[2]. It's a feasible option for paediatric diagnostic ophthalmic procedures with the advantage over halothane of providing complete access to the eye[3].Although propofol is often used in paediatric anaesthesia, there has been only limited scientific evidence on the use of propofol in children under three years of age[4]. But in some studies it has been used safely and proved excellent in terms of efficacy and ease of intubation in infancy[5]. Rapid onset, good haemodynamic tolerance, and a short duration of action are well established advantages of propofol 1% in children over 3 years of age. However, pain on injection[6] and spontaneous movements[7] during induction remain of particular concern in children. A potential advantage of propofol 2% could be a faster induction, and thus less pain on injection and a decreased incidence of involuntary movements[8]. The aim of this comparative study was to compare the induction characteristics of propofol 1% and 2% in a paediatric population undergoing short eye procedures.

MATERIAL AND METHODS

This study was conducted at LV Parsad

PATIENTS DEMOGRAPHIC DATA IN TWO GROUPS

Patients demographics data	Group A (Propofol 1%) n=50 Mean ± SD	Group B (Propofol 2%) n=50 Mean ± SD	Significance p value
Age(years)	7.2 ± 2.35	7.5 ± 1.51	>0.05 NS
Weight(kgs.)	24 ± 7.83	22 ± 8.72	>0.05 NS
Duration of anaesthesia(minutes)	43.5 ± 6.52	41 ± 5.66	>0.05 NS
Duration of surgery(minutes)	35 ± 3.12	33 ± 4.22	>0.05 NS
Sex M/F	31/19	28/22	
ASA status I/II	35/15	32/18	

Table I

Eye Institute, Hyderabad, India. Hundred patients between 5-13 years of age with American society of Anaesthesiologist (ASA) status I, and II scheduled for elective eye surgeries were enrolled in this study. Patients were divided into two groups of 50 each, written informed consent was obtained from the parents of 100 children. All the routine monitoring devices i.e. pulse oximeter, non invasive blood pressure, ECG, capnograph and temperature probe were placed before induction. Midazolam 0.5 mg- Kg^{-1} was given orally as premedication and EMLA cream was applied to both hands to receive either propofol 1% or 2%. Fentanyl 2 mg-kg^{-1} and then lidocaine 0.5%,1 ml was administered intravenously before injecting propofol, after 3 minutes of preoxygenation, Propofol 4mg/ kg bolus was given at a constant rate through a syringe. Tracheal intubation was performed 1 min after the end of bolus, when the patient stopped breathing with out the use of any neuromuscular blocking agent. Anaesthesia was maintained by Isoflurane 1% and 60% Nitrous oxide in oxygen through out the procedure. Pain on injection was considered when the child complained about it or when they withdrew their hand during the injection. Abnormal movements were defined as purpose-less movements of any part of the body during or immediately after the injection of propofol. Unconsciousness was defined as the absence of a reaction to verbal stimulation. Intubating conditions were assessed using a four point scoring system based on ease of laryngoscopy, jaw relaxation, position of vocal cords, degree of coughing and limb movements[9]. The quality of intubation was evaluated according to a widely used score as excellent, good, bad and impossible[3]. Side effects and time of recovery (from the end of propofol infusion to extubation) were recorded.

Unpaired Student's t test and Chi squared test were applied with $P<0.05$ was considered significant. Physical characteristics of the children and duration of surgery were comparable between the two groups.

RESULTS

Hundred patients (59 males, 41 females) were included in this study who were divided into two groups of 50 patients each. Patients in group A received Propofol 1% while patients in group B received Propofol 2%. Mean age was 7.2±2.35 years and 7.5±1.51 years in group A and B respectively. Out of 59 male patients 31 were in group A while 28 were in group B. Similarly female patients were 19 and 22 in group A and B respectively. Weight of patients in two groups was in a range of 20-30 kg. ASA status, duration of anaesthesia, duration of surgery, pre-medication, analgesia and maintenance of anaesthesia were similar for both groups (table No 1).

Results in two groups with different concentrations of Propofol i.e. 1% and 2% are compared and shown in (table No2). Onset of action or loss of consciousness was more rapid and quick in 2% compared to 1% Propofol (40s Vs 48s). The p value was 0.02 which is significant. Pain on injection was noticed in five patients (10%) and 10 patients (20%) after propofol 1% and 2% respectively. Spontaneous movements during induction occurred in 8 patients (16%) and 12 patients (24%, P=0.18); satisfactory intubation was done in 40 patients (80%) and 45 patients (90%, P=0.19), while spasm just after intubation was noticed in 1 patient (2%) and 3 patients (6%) receiving propofol 1% and 2% respectively. There was no significant difference in respect of haemodynamic response to both concentrations of Propofol.

DISCUSSION

Propofol is becoming popular in day case surgeries because of its rapid onset, good haemodynamic tolerance and short duration of action in adults as well as in children over three years of age[1,2] Different preparation and concentrations' have been used in different studies to achieve better results in terms of efficacy and quality, specially where long-term use of propofol is indicated. One such study done by Knibbe and

PATIENTS DEMOGRAPHIC DATA IN TWO GROUPS

Induction characteristics	Group A (Propofol 1%) n = 50 (%)	Group B (Propofol 2%) n = 50 (%)	p value
Time to loss of consciousness in seconds (mean ± SD)	48 ± 1.59	40 ± 1.85	<0.05
Pain on injection	4 (8)	8 (16)	>0.05
Purposeless movements	8 (16)	12 (24)	>0.05
Spasm just after intubation	2 (4)	3 (6)	>0.05
Intubation conditions	40 (80)	45 (90)	>0.05
Excellent	35 (70)	42 (84)	
Good	5 (10)	3 (6)	
Bad	0	0	
Impossible	0	0	

Table 2

Voortman who used different concentration of propofol in their study and concluded that alteration of the type of emulsion and higher concentration of propofol in the new parenteral formulation of propofol does not affect the pharmacokinetics and intubation characteristics of propofol, compared with the currently available product. High concentration can be administered safely and has the advantage of a reduction of the load of fat and emulsifier which may be preferable when long term administration of propofol is required[10].

We used two different concentration of propofol i.e. 1% and 2% in our study; the induction characteristics of these two concentrations were comparable. We noticed significant difference in onset time of two drugs i.e. (40s Vs 48s, P=0.02) in 2% and 1% of propofol concentrations respectively. Our results were comparable to the study done by Pellegrini who observed an onset time of 47s and 54s in two different concentration of propofol in paediatric patients undergoing ENT surgeries[8]. Knibbe observed an average time of 51 +_ 1.3s for loss of consciousness when 1% propofol was used as induction agent. Another study done by Edomwonyi, observed mean induction time of 55.25 ± 26.66 when 1% concentration of propofol been used[11].This finding is explained by the equivalent bolus rate, used to infuse either propofol 1% or 2%, thus infusing 2% led to administration of induction dose in a shorter time and to a higher propofol concentration gradient between plasma and the effect site. This may have facilitated the passage of propofol into the effect compartment, thereby shortening the exit rate constant from the central compartment[8].

Propofol is a feasible option for paediatric diagnostic ophthalmic procedures with the advantage over inhalational agent by providing complete access to the eye[3]. However pain on injection[6] and spontaneous movement[7], during induction remain of particular concern in children. A potential advantage of propofol 2% could be a faster induction, and thus less pain on injection and a decrease incidence of involuntary movements[8]. Pain on injection was observed in few patients in both of our studied groups i.e. 10% and 20% with propofol 1% and 2% respectively. Knibbe observed percentage of patients reporting pain on injection between different formulations of propofol was 17% [10]. As we have added lignocain in propofol before injection and also fentanyl was given I.V preoperatively, so the reduced incidence of pain on injection might be due to these strategies. One such study done by Nyman who used lignocaine with propofol in one group of patients while plain propofol in another group of patients and observed pain on injection in 33.3% and 61.0% (p=0.016) of patients in two groups respectively[12]. It has been shown that opioids decrease propofol related pain[13]. Spontaneous or purposeless movements following injection of either propofol 1% or 2% in our study were 18% and 30% (p=0.18) respectively. The less incidence of excitatory movements in both groups may be attributable to the less time spent in the excitation phase of induction when induced with I.V propofol.[14] The cause of these movements are of sub-cortical rather than a cortical nature, their cause remain unclear. A study done by Chan and Nickou observed 26% of patients had spontaneous movements when induced with propofol[15]. Borgeat and Fuchs in one of their study observed an incidence of 20% with 2% propofol when given at a rate of 4mg/kg while it was 90 % when given in less dosage i.e. 3mg/kg[16], so it's not only the concentration but dosage is also an important factor. In our study we used dosage of 4mg/kg in both groups and it was not a confounding factor.

The conditions of intubation were assessed

according to a score after propofol induction in both groups, and were found to be excellent and good with 80% and 90% (P=0.19) success rate in 1% and 2% groups of propofol respectively. Schippel assessed conditions of intubation in one of his study and concluded that excellent and good conditions for intubation as well as the ultrashort drug onset and intubation time demonstrate the good characteristics afforded by propofol at any concentrations to perform intubation in infancy[5]. In their studies by Batra and Klemola, intubating conditions were assessed using a four point scoring system based on ease of laryngoscopy, jaw relaxation, position of vocal cords, degree of coughing and limb movements[9]. They concluded that opioid administration before propofol provides acceptable tracheal intubation conditions in children and completely inhibited the increase in heart rate and mean arterial pressure associated with intubation[17]. Intubations were easy and smooth in almost all of our patients and haemodynamic changes were not different in both groups, although there are studies which shows fall of blood pressure with the use of propofol after induction[11]. But in our study we did not notice any gross changes in haemodynamic status of patients in both groups and they were stable haemodynamically till the end of surgery.

CONCLUSION

The present study shows that induction of anaesthesia in children with propofol 1% or 2% provided comparable clinical condition and propofol 2% is equally effective and safe in children as an induction agent. Moreover its use might be preferred when long-term administration of propofol is required. However further studies are needed to find out its beneficial aspects.

REFERENCES

1. Peggy C, David W, Gary J, Michael R. Use of propofol sedation in the paediatric emergency department. J Canad Paediat Soc 2003; 8: 123-6.
2. Hertzog JH, Campbell JK, Dalton HJ. Propofol anaesthesia for invasive procedures in ambulatory and hospitalized children; Experience in the paediatric intensive unit. Paediatrics 1999; 103: 30-2.
3. Madan R, Kapoor I, Balachander S, Kathirvel S, Kaul HL. Propofol as a sole agent for paediatric day case diagnostic ophthalmic procedures: Comparison with halothane anaesthesia. Paediatr Anaesth 2001;11:671-7.
4. Pessenbacher K, Gutmann A, Eggenreich U, Gschanes A , Rehak P, List WF. Two propofol formulations are equivalent in small children aged 1 month to 3 years. Acta Anaesthesiol Scand 2002; 46:257-63.
5. Schippel P, Wild L, Burkhart U, Olthoff D. Propofol for induction of infants after halothane induction. Anaesthesist 1999;48:317-24.
6. Picard P, Tramer MR. Prevention of pain on injection with propofol: A qualitative systemic review. Anesth Analg 2000; 90: 263-9.
7. Borgeat A, Dessibourg C, Popovic V. Propofol and spontaneous movements: An EEG study. Anesthesiology 1991; 74: 24-7.
8. Pellegrini M, Lysakowski C, Dumont L, Borgeat A, Tassonyi E. Propofol 1% versus propofol 2% in children under going minor ENT surgery. Br J Anaesthesia 2002; 90: 375-7.
9. Batra YK, Al Qattan AR, Ali SS, Qureshi MI, Kuriakose D, Migahed A. Assessment of tracheal intubating conditions in children using remifentanil and propofol without muscle relaxant. Paediatr Anaesth 2004;14:452-6.
10. Knibee CA, Voortman HJ, Aarts LP, Kuks PF, Lange R, Langemeijer HJ, et al. Pharmacokinetics, induction of anaesthesia and safety characteristics of propofol 6% SANZ Vs Propofol 1% and Diprivan 10 after bolus injection. Br J Clin Pharmacol 1999;47:653-60.
11. Edomwonyi NP, Okonofua BA, Weerasinghe AS, Daugnan F. A comparative study of induction and recovery characteristics of propofol and midazolam. Niger Postgrad Med J 2001;8 (2) :81- 5.
12. Nyman Y, Von Hofsten K, Georgiadi A, Eksborg S, Lonnqvist PA. Propofol injection pain in children: A prospective randomized double blind trial of a new propofol formulation versus propofol with added lidocain. Br J Anaesth 2005;95: 222-5.
13. Grauers, Liljeroth E, Akeson J. Propofol infusion rate does not affect local pain on injection. Acta Anaesthesiol Scand 2002;46:361-3.
14. Walker SM, Haugen RD, Richards A. A comparison of sevoflurane and Halothane in paediatric day case surgery. Anaesth Intens Care 1997;25:643- 9.
15. Chan A, Nickou E, Thornton C, Dore C, Newton DE. Spontaneous movements after injection of propofol. Anesthesia 1996;51 :663-6.
16. Borgeat A, Fuchs T, Tassonyi E. Induction

characteristics of 2% propofol in children. Br J Anaesth 1997, 78: 433-5

17. Klemola UM, Hiller A. Tracheal intubation after induction of anaesthesia in children with propofol-remifentanil or propofol- recuronium. Can J Anaesth 2000;47(9):854.

Address for Correspondence:
Dr. Nasreen Laiq
H.No. 156, Street No. 3 Sector N-2,
Phase 4 Hayatabad Peshawar.