Original Research Article

Comparative study of haemodynamic response of propofol with ketamine versus thiopental sodium as sole anaesthetic agent in minor surgical procedures

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Abstract

Background: Day care surgery and anesthesia is a upcoming specialty and need of hour in today's era. Most of the minor surgery are done in day care, for which early recovery from anesthesia and surgery is a primary goal of anesthesia. With the new advances in anesthesia and newer drugs, it's possible to achieve desired goal. **Aim:** Our study was conducted to compare hemodynamic effects of Ketamine and Propofol versus Thiopentone during induction and maintenance of general anesthesia for minor surgical procedures. **Methods:** Two hundred patients undergoing general anaesthesia for minor surgical procedure were randomly divided into two groups to receive the induction agent Propofol + ketamine (Group A) or Thiopentone (Group B) in hundred patients each. The hemodynamic parameters namely heart rate, systolic, diastolic, mean blood pressure, SPO2 and ECG changes were monitored before induction and after induction at 1 minutes, 3 minutes, 5 minutes and 10 minutes. **Conclusion:** Combination of propofol and ketamine gives better haemodynamic stability during induction and maintenance of general anaesthesia than the thiopentone and it also decrease recovery duration compared to thiopentone in minor surgical procedure.

Key Word: Propofol, ketamine, thiopentone, minor surgical procedure, hemodynamic, intravenous.

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INTRODUCTION

Now a day's most of the elective surgeries are performed in outpatient setting. The rapid growth of these types of surgeries would have not been possible without changing role of anaesthesiologists and development of new and short acting anaesthetic agents, which have smooth induction properties, stable intraoperative and postoperative hemodynamic and excellent recovery. The ideal intravenous anesthetic drug should provide hypnosis, amnesia, analgesia and muscle relaxation without any side effects.[1] Hemodynamic variations, especially hypotension occurs after intravenous (IV) administration of various anesthetic agents such as thiopentone and propofol. Several studies have been conducted in order to find out anesthetic agent with least hemodynamic changes. Thiopental sodium has been a popular IV anesthetic agent for many years throughout the world. It causes decrease in myocardial contractility as well as peripheral vasodilation. Heart rate may also fall but there is often a reflex tachycardia probably due to central vagolytic effect.[2] cardiac output is maintained due to increase in heart rate and increase in myocardial contractility from compensatory baroreceptor reflex.[3] Propofol is a diisopropylphenol IV hypnotic agent commonly used for induction and maintenance of general anesthesia[4] is ideal for short and ambulatory surgical procedures requiring general anesthesia as onset as well as recovery is rapid with few undesirable side effects. However, when used as sole induction agent it may cause 25% to 40% reduction in systolic blood pressure which is significant [5] and similar changes have been noted in mean

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and diastolic blood pressure. Decrease in blood pressure is due to decreased systemic vascular resistance and reduced myocardial contractility (MC). Despite the decrease in arterial pressure heart rate remains unchanged due to depression of baroreceptor response.[6] Ketamine, a phencyclidine derivative has long history of successful use specially for short surgical procedures. It has potent analgesic activity which releases catecholamines with subsequent tachycardia and hypertension.[7] Intravenous ketamine causes a rise in systemic and pulmonary arterial pressure, heart rate, cardiac output and myocardial O2 requirement. Direct stimulation of CNS leading to increase in sympathetic outflow seems to be most important mechanism for CVS stimulation.[8] The ideal IV anesthetic drug would provide hypnosis, amnesia, analgesia, and muscle relaxation without undesirable cardiac and respiratory depression.[1] Because no single drug is ideal, many newer IV anaesthetics, often used together, have offer similar desired effects .IV anaesthetic use is increasing day by day because of improved methods of drug delivery systems and newer IV compound. Propofol causes fall in blood pressure of around 30-40% of mean arterial pressure,[5] i.e more than a fall in blood pressure by thiopentone. Thiopentone causes increase in heart rate,[2] but propofol doesn't affects heart rate.[6] Our study was conducted to compare heamodynamic effects of Ketamine and Propofol versus Thiopentone during induction and maintenance of general anaesthesia for minor surgical procedures

MATERIAL AND METHOD

Our study was conducted after approval from Ethical Committee. Written informed consent was obtained by the attending anaesthesiologist on the morning of surgery.

Inclusion Criteria: 1. Patients undergoing elective surgical procedures requiring general anaesthesia. 2. ASA physical status grade I to II. 3. Patients between age 18 to 60 years of either sex. 4. Procedures lasting for 20 -30 minutes.5. Weight of patient should be between 30-80 kgs.

Exclusion Criteria: 1. Emergency procedures 2.ASA physical status III and above 3. Known sensitivity to drugs being used 4. Patients having severe cardiovascular and respiratory diseases.

A total of 200 patients of ASA grade I and II aged between 18 to 60 years of either sex posted for elective minor surgery under general anesthesia were randomly categorized into two groups as follows: **Group A**: Propofol + Ketamine All patients in this group received Inj. Propofol 2mg/kg induction dose and Inj. Ketamine 1mg/kg analgesic dose and maintained with supplementary bolus dose of propofol if required during procedure. **Group B:** thiopentone alone All patients in this group received Inj. Thiopentone sodium 5mg/kg of body weight with supplementary bolus dose if required during procedure. On the day of surgery after obtaining the consent and explaining the procedure patient was taken to operative table. Monitors like stethoscope, pulse oximeter, manual sphygmomanometer and NIBP were attached. Preoperative baseline parameters like heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), oxygen saturation (SPO2), and ECG lead II were recorded and mean arterial pressure (MAP) were calculated from above parameters. All patients were monitored intra-operatively for the said parameters at 1 minute, 3 minutes, 5 minutes and 10 minutes of the procedure.

Statistical Analysis: Percentage distribution of age group, gender and operative procedure was compared in between the groups using non parametric (Pearson Chi-Square test) statistical test. Mean difference of Age, Operative duration, SBP, DBP, Mean BP, HR, SPO2 was compared between the groups using unpaired t test. Difference of hemodynamic variables at 1 min, 3 min, 6 min and 10 min was compared to baseline preoperative values using paired test in each group. All hemodynamic variables were compared with each other by ANOVA multiple comparison test in both the groups. The Significance level of 0.05 levels was set for the entire statistical test at 95% confidence interval.

RESULT

Table 1:

Operative procedure	Group A (Propofol and Ketamine)	Group B (Thiopentone)	Total
D and C	27(27%)	20(20%)	47(23.5%)
D and E	32(32%)	37(37.0%)	69(34.5%)
Debridment	6(6%)	8(8%)	14(7%)
Lipoma and Mass Excission	35 (35%)	35 (35%)	70 (35%)
Total	100 (100.0%)	100 (100.0%)	200 (100.0%)
Chi-Square Tests	Value	df p value	Significance
Pearson Chi-Square	1.691	3 0.639	Not significant (p>0.05)

Within Group A, the operative procedure in 35% was Lipoma and mass excision, in 27% it was D and C, 32% had D and E and debridment was needed in 6%. In Group B, 35% were posted for lipoma and mass excision, 20% for D and C, 37% for D and E and 8% needed debridment. There was statistically no significant ($p>0.05$) difference of the type of operative procedures undergone by patients within group A and Group B.

Table 2:

Baseline	Group	Mean ± Std. Deviation	t	p value	Significance
SBP	Group A	120.94±2.44	0.417	0.677	N.S
	Group B	120.80±2.31			
DBP	Group A	83.06±3.65	-0.069	0.945	N.S
	Group B	83.02±4.53			
Mean BP	Group A	95.68±2.42	-0.184	0.845	N.S
	Group B	95.61±3.15			
HR	Group A	82.1±3.14	0.611	0.542	N.S
	Group B	81.9±3.11			
SPO_2	Group A	99.2±0.9	0.758	0.449	N.S
	Group B	99.3±0.84			

Mean heart rate of thiopentone induction group was significantly ($p<0.01$) higher than propofol + ketamine induce group throughout the procedure. Compared to baseline value mean heart rate rise in thiopentone induced patients were more than that of propofol + ketamine induction group.

Table 3:

Group A	Baseline	1 min	3 min	5 min	10 min	P value
Systolic Blood pressure	120.94±2.44	110.58±5.77	114.3±8.2	115.7±5.9	118.1±4.1	<0.01
Diastolic Blood Pressure	83.1±3.65	74.9±4.3	78.9±3.4	79.5±4.01	79.7±4.4	<0.01
Mean Blood Pressure	95.7±2.4	86.8±3.6	90.7±3.4	91.6±3.6	92.5±3.5	<0.01
Heart rate	82.13±3.15	84.3±2.7	86.8±2.1	82.05±3.26	85.4±2.6	<0.01
SPO_2	99.3±0.9	98.3±0.9	99.1±0.64	99.4±0.7	99.5±0.5	<0.01

There was fall in systolic blood pressure after thiopentone induction which was significant ($p<0.05$) than propofol + ketamine induction up to the first 5 minutes. Compared to baseline, SBP fall in thiopentone induced patients was more than that of propofol + ketamine induction group. The diastolic blood pressure upto first 5 min of Thiopentone group was significantly ($p<0.01$) lower than that of the Propofol ketamine induced group. The diastolic blood pressure at 5 and 10 min of Thiopentone group was significantly ($p<0.01$) higher than that of the Propofol ketamine induced group.

Table 4:

Group A	1 min	3 min	5 min	10 min
Systolic Blood pressure	10.4±6.1**	6.6±8.9**	5.2±6.1**	2.8±4.39**
Diastolic Blood Pressure	8.1±5.7**	4.2±5.4**	3.6±5.4**	3.4±5.6**
Mean Blood Pressure	8.9±4.2**	5±4.4**	4.1±4.2**	3.2±4.1**
Heart rate	-2.2±4.46**	-4.7±4.4**	0.08±4.60	-3.3±4.0**
SPO2	0.9±1.5**	0.21±1.1*	-0.08±1.1	-0.14±1

Table 5:

Group B	1 min	3 min	5 min	10 min
Systolic Blood pressure	16.7 ±4.1**	12.1±8.3**	7.1±6.0**	3.9±6.5**
Diastolic Blood Pressure	13.3±5.9**	8.9±6.7**	1.9±5.3**	0.2±5.7
Mean Blood Pressure	14.5±4.5**	9.9±5.2**	3.6±4.0**	1.5±4.2**
Heart rate	-12.06±1.94**	-14.74±6.1**	-13.02±4.5**	-10.3±6.1**
SPO2	0.72±1.4**	0.38±1.1**	0.27±1.0*	0.05±0.9

Mean blood pressure after thiopentone induction which was lower than propofol + ketamine induction at 1 and 3 min while higher at 10 min which was statistically significant ($p<0.01$). No abnormal ECG changes were noted in any patients within the thiopentone induction group and propofol + ketamine induction group throughout the procedure.

Table 6:

Group A Vs Group B	Baseline	1 min	3 min	5 min	10 min
HR	0.27	-9.6**	-9.78**	-12.8**	-6.77**
SBP	0.14	6.46**	5.66**	2.08*	1.28
DBP	0.04	5.27**	4.72**	-1.7**	-3.12**
MBP	0.07	5.67**	5.03**	-0.44	-1.65**
SPO_2	-0.01	-0.19	0.16	0.34**	0.18**

There was no significant difference of SPO2 in group A (propofol+ketamine) and B (thiopentone) which is 1% so it has no clinical importance.

Table 7: Comparison of recovery duration in between Group A (Propofol and Ketamine) with Group B (Thiopentone).

Recovery Duration (min)	Group A (Propofol and Ketamine)	Group B (Thiopentone)
Mean± Std. Deviation	6.10±1.14	8.43± 2.23
t	-9.299	
p value	<0.01	
Significance	H.S	

Recovery had occurred in propofol ketamine group by 6.1 min which was earlier than thiopentone group by 8.43 min so there was statistically highly significant ($p<0.01$) difference in recovery period.

DISCUSSION

During induction of anaesthesia one of the important factors is prevention of hemodynamic instability. An ideal IV agent must have rapid, smooth onset with good recovery and very minimal hemodynamic changes and side-effects are required in day care minor surgeries. Both Propofol and Ketamine have smooth and rapid onset of action, but they causes significant hemodynamic changes if used as sole induction agents which can be detrimental in high risk patients.[9,10] Some have used various combinations of ketamine and propofol to minimize other adverse effects of both agents and to avoid hemodynamic changes also. In our study the demographic data were comparable for age, sex, weight, type of procedure and duration of procedure. In our study the mean heart rate in Group B was higher than in Group A and also there was higher variation above the baselines in it. Group A patients had normal mean heart rate compared to Group B patients and were stable. Similar findings were noted by Asthana V *et al*, in study on 90 ASA I, II patients of either sex and within age group16-65 years, undergoing minor surgical procedures under general anaesthesia not requiring endo tracheal intubation. He had observed that due to thiopentone anaesthesia there was increase in heart rate above the base line value throughout the period of observation.[11] Gerald Edelist *et al*, in his study found decreased in Heart rates throughout the induction period with propofol, while average values increased during the first minute and then decreased in the thiopentone group. Average heart rates had began to increase in both groups and were relatively constant throughout the remaining period of anaesthesia duration.[12] In our study, we found that the mean Systolic Blood Pressure was lower to the base line in Group B when compared with Group A at 1 min, 3 min and 5 min after induction, which was statistically significant. Our findings are in accordance with Garg K *et al*, he found that the combination of propofol 2mg/kg and ketamine 1mg/kg led to a transient fall in SBP, DBP owing to the predominant hemodynamic effects of propofol during first two minutes which returned to normal by fifth minute due to opposing hemodynamic effects of ketamine,[13] Also similar results were noted where this combination of anaesthetic agents for induction of anaesthesia was used.[14,15] In our study we found mean arterial blood pressure of Group A was higher at 1 and 3 min. The difference was statistically highly significant (p 0.05) difference of the MBP in between Group A and Group B at 5 min. Asthana V *et al*, had Compared propofol and ketamine for induction and found that there was a significant fall in MBP in both Propofol and Thiopentone group. Also in our study we have found fall in mean arterial blood pressure in Thiopentone group.[11] Kamalipour H. *et al* had stated that there was a significant decrease in MAP in ketamine-propofol at 1 min and 5 minutes after induction of anaesthesia compared to the baseline values.[16] In our study though there was statistically significant difference of SPO2 but it was very small (less than 1%) to be considered for clinical significance in between the two groups. SPO2 was constantly above 98% in both the groups. In the study of Lalita D *et al*, they found that the oxygen saturation was maintained at 92% throughout the surgery in both Thiopentone and Propofol induced groups.[17] In study by Begec Z *et al*, they found that no patient suffered laryngospasm, desaturated or profound decrese in blood pressure or heart rate requiring treatment. but in the ketamine group, two patients had excessive secretions.[18] In our study Recovery had

occurred earlier in propofol+ketamine group by 6.1 min and in Group thiopentone it was found delayed at 8.43 min compared to propofol+ketamine group. There was statistically highly significant ($p<0.01$) difference of lower recovery duration in Group propofol+ketamine compared to thiopentone group Gerald Edelist *et al*, in his study found mean time to orientation with all patients included was 11.6 minutes for thiopentone, Time to awakening, response time to a verbal command, and time to orientation were measured from the termination of all anaesthesia. These recovery times were significantly shorter for the propofol group the mean time to response to a verbal command was 5.8 minutes for propofol and 8.7 minutes for thiopentone.[12] In the study of Lalita D *et al*, they found that thiopentone group required 9.5 min for orientation after discontinuing nitrous oxide which was very higher than propofol group so it was statistically significant.[17] Saha Kaushik *et al*, studied that the recovery time for propofol+ketamine group was 11.71 min which was longer because of the maximum peak effect of ketamine (5 to 10 min).[19] Asthana V *et al*, had Compared mean duration of recovery (eye opening) after cessation of anesthetic was at 6.6±1.2 min in thiopentone group while 4.46±1.1min in propofol group and in ketamine group it was 6.02±.96min.[11]

CONCLUSION

Combination of propofol and ketamine gives better haemodynamic stability during induction and maintenance of general anaesthesia than the thiopentone and it also decrease recovery duration compared to thiopentone in minor surgical procedure.

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