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Comparative Study between Propofol and Propofol with Ketamine in Ambulatory Anaesthesia

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Abstract:*In the present study propofol alone with propofol ketamine combination was compared for ambulatory anaesthesia.This was a randomized double blinded studyl trial conducted in 80 patients belonging to ASA 1 &II, aged between 20-50 years,40 in each group.Group-A: Propofol alone,Group-B:Propofol-Ketamine combination..Induction doses, Systolic,Diastolic Blood pressure and Mean arterial pressure, Pulse rate, Oxygen saturation,Complications if any were measured. The parameters were subjected to T test analysis and found statistically significant difference in induction doses,systolic,diastolic,mean arterial pressures,complications.*

Keywords:*Ambulatory, Co-induction, Ketamine, Propofol, Total intravenous anaesthesia*

I. Introduction

The administrion of anaesthesia with the intent to admit and discharge the patient on the day of the surgical procedure is known as ambulatory anaesthesia. The continued growth in ambulatory surgery is related to expansion in minimally invasive surgical techniques and improved anaesthetic techniques.

Total intravenous anaesthesia as currently practiced uses several types of drugs, each performing a specific role..

Propofol is a newer intravenous anaesthetic agent having favourable pharmacokinetic profile. It has already achieved considerable popularity for induction and maintainance of anaesthesia for short duration surgeries. Propofol has high clearance rate and rapid decline in blood concentration.

Ketamine which is water soluble intravenous anaesthetic belongs to phencyclidine group of drugs. It is the only intravenous anaesthetic which has hypnotic, analgesic, amnestic properties and cheaper than fentanyl and butorphanol.

Hence in this study propofol alone is compared to propofol with ketamine regimen for TIVA in ambulatory anaesthesia

II. Aims And Objectives

To compare the propofol alone (Group P) and combination of propofol with ketamine (Group PK) in ambulatory anaesthesia in 80 patients, 40 of each group in terms of-

2.1 Induction requirements of propofol and ketamine
2.2 Haemodynamics intraoperatively
2.3 Time of recovery from induction
2.4 Incidence of postop complications/side effects
2.5 Duration of pain relief postoperatively

III. Patients And Methods

3.1Inclusion Criteria:

Patients of either sex, with ASA Grade-I and Grade-II, Patients aged between 20-50 years.

3.2Exclusion Criteria:

Patients with ASA Grade-III, IVandV below 20 years of age and above 50 years of age, unwilling patients, history of allergy to drugs

Mode of Selection:Randomized double blind

3.3 Equipment used:-

18G Cannulae,Drugs.
Disposable plastic syringes.
Philips Multiparameter Monitor [SpO_2 , PR, NIBP].

Anaesthesia machine, Resuscitation Equipment (stand by)

3.4 Preoperative Period:

Preanaesthesia evaluation included detailed history and physical examination to rule out cardiorespiratory disease and to know contraindications to drugs and techniques used. Haemoglobin percentage, bleeding time, clotting time, blood grouping and typing and other routine investigations were done for each case.The anesthetic procedure was briefly explained to the patient. An informedwritten consent was obtained.

3.5 Intra operative period:

Once shifted to the operating room, All the patients were premedicated with injection glycopyrolate 0.2mg + injection ondansetron 4mg + injection fentanyl 1 microgram/kg + injection midazolam 1 mg after securing 18G cannulae and connecting to NIBP, pulse oximeter and ECG monitor.

All emergency resuscitation equipments and emergency drugs were kept ready. The anesthesia machine was alsochecked along with the oxygen delivery system.

These patients were randomly assigned toone of the two groups in a double blind manner.viz;

Group P:40 patients received propofol slowly till the point of induction

Group PK: 40 patients ketamine 0.5 mg/kg i.v. slowly followed by propofol i.v. till the point of induction.

The induction parameters chosen were non-responsiveness to verbal commands & loss of eyelash reflex.

Baseline Pulse Rate, Blood Pressure, Respiratory Rate, SpO_2 were recorded.

Anaesthesia was maintained with propofol bolus 10mg intravenously in propofol group, propofol-ketamine bolus 10+10mg intravenously in propofol-ketamine group based on requirements – namely - spontaneous movement, appearance of tears, increase in respiratory rate, tachycardia, high blood pressure. Spontaneous respiration was maintained with 100% O2 with mask and Bain's circuit with assistance in times of apnoea.

Apnoea was defined as absence of spontaneous breathing attempts for greater than or equal to 20 seconds.

Hypoventilation defined as respiratory rate <8/minute

Desaturation was defined as Spo2<93% at any time

Hypotensionwas defined as <90/50 mm of hg

Hypertension was defined as >140/90 mm of hg

All these events were noted and appropriate action was taken.

Basal Pulse rate, blood pressure, ECG, respiratory rate and saturation were noted, followed by every 5 minute till the end of the procedure.Duration of pain relief post operatively was noted in both groups.

Patients were watched for nausea and vomiting. And to be treated with inj. ondansetron--- 100-150microgram/kg i.v if needed.

Emergence reactions (manifested as excitement, confusion, euphoria, fear) to be treated with inj. midazolam 0.02 –0.05 mg/kg i.v if needed.

The time for first analgesic demand was noted. The patients regular analgesics were administered for the remaining 24 hours

3.6 Statistical analysis:

The student t-test was used to assess the statistical significance of paired data and a p value of <0.05 was considered significant.

IV. Observations And Results

The results are as follows:

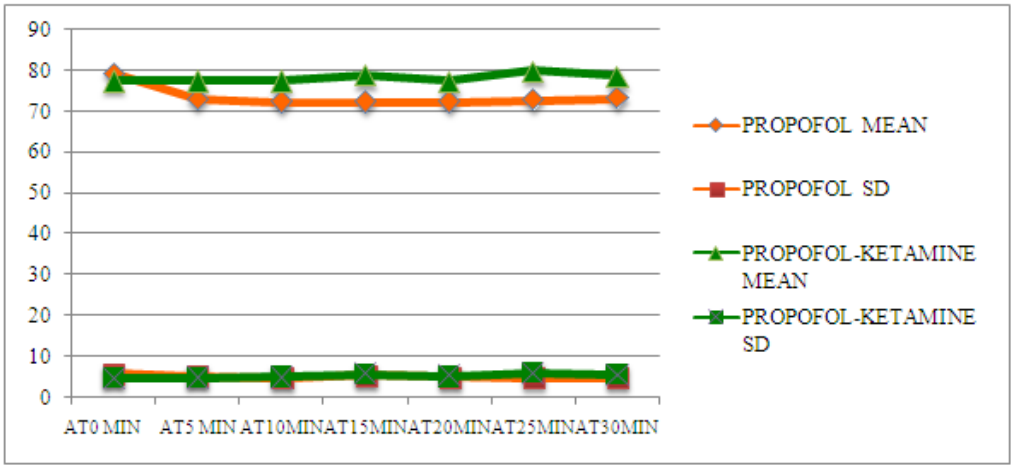
Demographic profiles of the patients scheduled for study were comparable

Table 4.1: Intergroup comparision of changes in pulse rate

	PROPOFOL		PROPOFOL-KETAMINE				
MEAN PR	Mean	SD	Mean	SD	T stat	P VALUE	INFERENCE
AT0 MIN	79.3	5.86	77.6	4.78	1.42	>0.05	NS
AT5 MIN	72.9	5.24	77.6	4.99	-4.06	<0.001	HS
AT10MIN	72.2	4.87	77.5	5.10	-4.71	<0.001	HS
AT15MIN	72.3	5.42	78.9	5.73	-5.33	<0.001	HS
AT20MIN	72.3	5.16	77.4	5.29	-4.37	<0.001	HS
AT25MIN	72.7	4.89	80.0	6.04	-5.98	<0.001	HS
AT30MIN	73.1	4.92	78.6	5.49	-4.68	<0.001	HS

NS-Nothing significant, HS-Highly significant

Graph: Intergroup comparision of changes in pulse rate



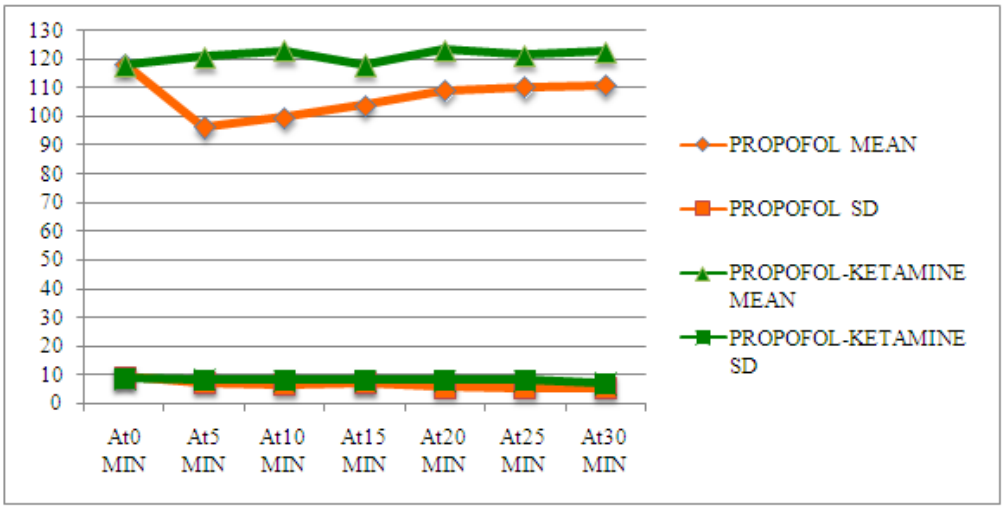
SD-Standard Deviation

Table 4.2: Intergroup comparision of changes in systolic blood pressure

Mean Systolic BP	PROPOFOL		PROPOFOL-KETAMINE		T stat	P - Value	Inference
	Mean	SD	Mean	SD			
At0 MIN	118.4	9.36	117.9	8.77	0.22	>0.05	NS
At5 MIN	96.3	7.35	120.6	8.28	-13.89	<0.001	HS
At10 MIN	99.7	6.68	122.9	8.14	-13.96	<0.001	HS
At15 MIN	103.8	7.03	117.9	7.99	-8.43	<0.001	HS
At20 MIN	108.9	5.64	123.3	7.93	-9.33	<0.001	HS
At25 MIN	110.1	5.35	121.4	7.95	-7.46	<0.001	HS
At30 MIN	110.9	5.45	122.6	6.99	-8.31	<0.001	HS

NS-Nothing significant, HS-Highly significant

Graph: Intergroup comparision of changes in systolic blood pressure



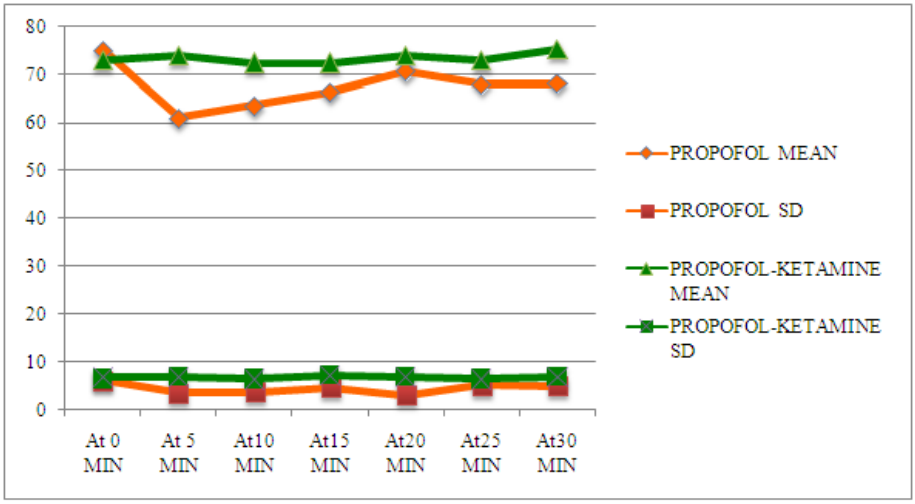
SD-Standard Deviation

Table 4.3: Intergroup comparision of changes in Diastolic blood pressure

Mean Diastolic BP	PROPOFOL		PROPOFOL-KETAMINE		T stat	P - Value	Inference
	Mean	SD	Mean	SD			
At 0 MIN	75.1	6.14	72.9	6.67	1.53	>0.05	NS
At 5 MIN	60.9	3.54	74.0	6.84	-10.76	<0.001	HS
At10 MIN	63.4	3.77	72.4	6.50	-7.61	<0.001	HS
At15 MIN	66.3	4.68	72.5	7.19	-4.53	<0.001	HS
At20 MIN	70.6	3.08	73.9	6.84	-2.74	<0.05	HS
At25 MIN	67.9	5.07	72.9	6.39	-3.84	<0.001	HS
At30 MIN	68.1	4.93	75.3	6.83	-5.44	<0.001	HS

NS-Nothing significant, HS-Highly significant

Graph: Intergroup comparision of changes in Diastolic blood pressure



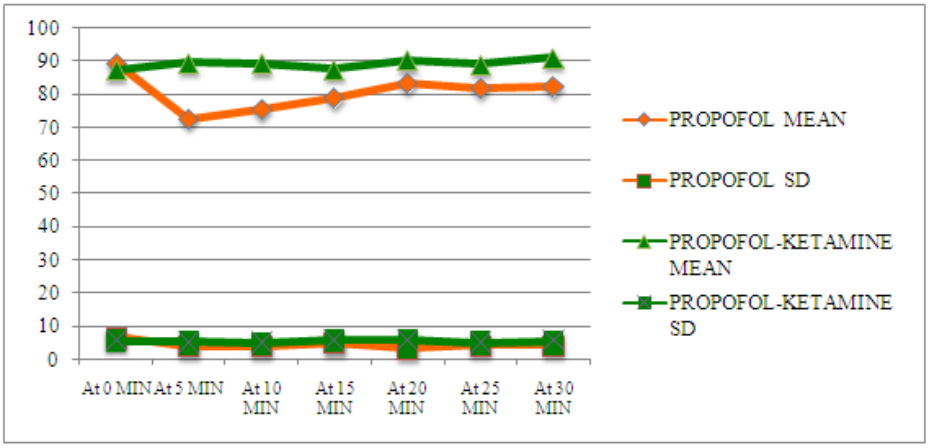
SD-Standard Deviation

Table 4.4: Intergroup comparision of changes in Mean arterial pressure

Mean Arterial Presure	Propofol		Propofol-ketamine		T stat	P - Value	Inference
	Mean	SD	Mean	SD			
At 0 MIN	89.5	6.94	87.3	5.74	1.48	>0.05	NS
At 5 MIN	72.6	4.09	89.5	5.39	-15.73	<0.001	S
At 10 MIN	75.4	4.14	89.2	5.17	-13.14	<0.001	S
At 15 MIN	78.8	4.99	87.6	6.03	-7.11	<0.001	S
At 20 MIN	83.3	3.45	90.3	5.86	-6.46	<0.001	S
At 25 MIN	81.9	4.46	89.1	5.33	-6.48	<0.001	S
At 30 MIN	82.3	4.34	91.1	5.67	-7.73	<0.001	S

NS-Nothing significant, HS-Highly significant, S-Significant

Graph: Intergroup comparision of changes in Mean arterial pressure



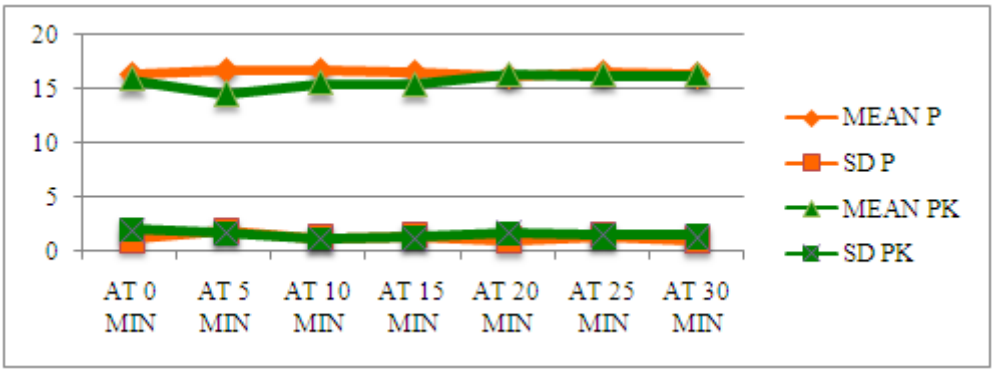
SD-Standard Deviation

Table 4.5: Intergroup comparision of changes in mean respiratory rate

Mean Respiratory Rate	PROPOFOL		PROPOFOL-KETAMINE		T stat	P - Value	Inference
	Mean	SD	Mean	SD			
At 0 MIN	16.3	1.19	15.8	2.07	1.35	>0.05	NS
At 5 MIN	16.75	1.96	14.5	1.74	5.43	<0.001	HS
At 10 MIN	16.7	1.32	15.45	1.19	4.43	<0.001	HS
At 15 MIN	16.45	1.47	15.35	1.31	3.54	<0.001	HS
At 20 MIN	16.15	1.05	16.35	1.78	-0.77	>0.05	NS
At 25 MIN	16.5	1.47	16.25	1.58	0.87	>0.05	NS
At 30 MIN	16.3	1.07	16.2	1.47	0.43	>0.05	NS

NS-Nothing significant, HS-Highly significant

Graph: Intergroup comparision of changes in mean respiratory rate



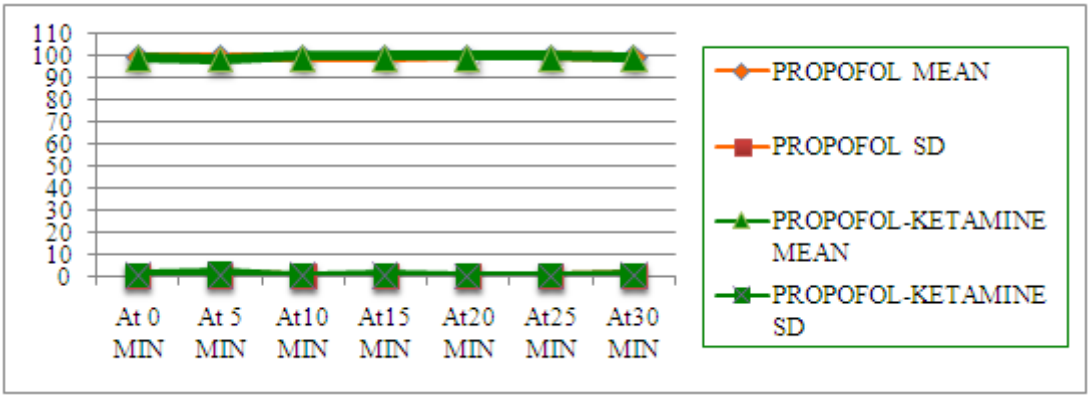
SD-Standard Deviation

Table 4.6: Intergroup comparision of changes in mean oxygen saturation

Mean oxygen saturation	PROPOFOL		PROPOFOL-KETAMINE		T stat	P - Value	Inference
	Mean	SD	Mean	SD			
At 0 MIN	99.8	0.67	99.5	0.96	1.22	>0.05	NS
At 5 MIN	99.6	0.81	98.6	1.52	3.68	<0.001	HS
At10 MIN	99.8	0.61	99.8	0.67	0.35	>0.05	NS
At15 MIN	99.8	0.61	99.8	0.81	0.35	>0.05	NS
At20 MIN	99.9	0.53	99.8	0.61	0.39	>0.05	NS
At25 MIN	100.0	0.53	99.9	0.53	0.28	>0.05	NS
At30 MIN	99.8	0.67	99.5	0.90	1.69	>0.05	NS

NS-Nothing significant, HS-Highly significant

Graph: Intergroup comparision of changes in mean oxygen saturation



SD-Standard Deviation

Table 4.7: Induction dose requirements of propofol in both groups

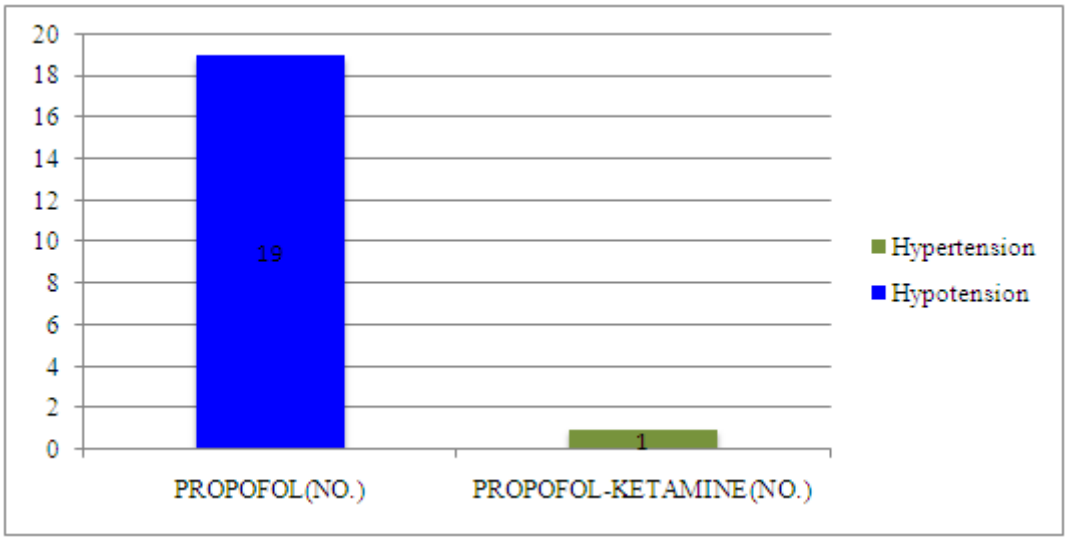
	Induction dose (Mean+/-SD)mg/kg	P value
PROPOFOL group	2.02+/-0.16	<0.001
PROPOFOL-KETAMINE group	1.62+/-0.1	

Table 4.8: Time to recover from induction doses in study groups

NS-Nothing significant, HS-Highly significant

	MEAN		P VALUE	INFERENCE
	PROPOFOL (MIN)	PROPOFOL-KETAMINE(MIN)		
Time of recovery from induction dose	2.63	9.80	<0.001	HS

Graph: Intergroup comparision of sideeffects/complications



(NO. – Number)

Table4.9: Duration of pain relief postoperatively/time taken for first analgesic demand

	PROPOFOL	PROPOFOL-KETAMINE
Time for first analgesic demand (MIN)	8.6 +/- 1.89	48.5 +/- 7.61

V. Discussion

The availability of rapid, shorter-acting anesthetic, analgesic, and muscle relaxant drugs has clearly facilitated the recovery process after surgery, and the development of minimally invasive surgical techniques allowed more extensive procedures to be performed on an ambulatory basis, irrespective of the patient's preexisting medical conditions.[1]Minimally invasive ambulatory surgery has clear economicbenefits

Total intravenous anaesthesia has been a subject of interest for all anaesthesiologists, as this is the best route to avoid operation theatre pollution. TIVA was initially attempted with a single drug (eg: thiopentone, propofol) but was associated with side effects and no drug was found to give complete anesthesia.

Propofol is a commonly used induction agent in day care procedures. When used as a sole agent, require a larger dose of propofol. This large dose needed for induction may be associated with haemodynamic and respiratory effects like hypotension,[2] bradycardia, apnoea or hypoventilation.

Ketamine which is water soluble intravenous anaesthetic belongs to phencyclidine group of drugs.[3] It is the only intravenous anaesthetic which has hypnotic, analgesic, amnestic properties and economical than fentanyl and butorphanol.[3]

Ketamine when used in subanaesthetic doses reduces the dose of propofol required for induction. This practice of administering a small dose of other anaesthetic agent to reduce the total dose of the induction agent is known as co-induction.[4] It provides haemodynamic stability.

Study in 2008 to know the efficacy of ketamine(PK) and midazolam(PM) as co-induction agents with propofol(P) for laryngeal mask insertion in children was done by Shiba Goel M.D, Neerja Bhardwaj M.D, and kajal jain MD.[5] In group P, systolic blood pressure (SBP) showed a significantly greater decrease compared to group PK and group PM ($P < 0.005$). Only 5% of patients in groups PK and PM showed >20% fall in SBP compared to 89% in group P ($P < 0.005$). More children in groups PK and PM had acceptable conditions for LM insertion compared to group P ($P < 0.05$). The time to achieve Steward Score of 6 was longer in groups PK and PM compared to group P ($P < 0.005$). In children, the combination of propofol with ketamine or midazolam produces stable hemodynamics and improved LM insertion conditions but is associated with delayed recovery.

Hence, the present study was undertaken to study the effectiveness of ketamine as co-induction agent with propofol in comparision to propofol alone.

A study was conducted by Briggs and co-workers[6] in 1981 using different doses of propofol (1-3 mg/kg) as a main agent for short surgical procedures. They found that with the 1.75 mg/kg, not all patients were anaesthetized and 2 mg/kg was a satisfactory induction dose. Recovery was rapid with almost all patients and there was absence of emetic sequel.

Kaushik Saha et al1[7] in 2001 too found a statistically significant decrease in the induction dose of propofol in combination with ketamine, in comparision to fentanyl. In our study also, induction dose of propofol was decreased in propofol-ketamine combination group.

Similar to the study of Briggs and co-workers, our study was also found the mean induction dose requirement of propofol in propofol alone group was 2.02 +/- 0.16 mg/kg. And in propofol-ketamine group mean induction dose of propofol was 1.62 +/- 0.10 mg/kg, which was statistically significant.

A comparision of combination of propofol-fentanyl and propofol with ketamine in 18 patients who underwent non-cardiac surgery was done by Guit and co-workers[8](1991),published in 1999 who concluded that propofol ketamine combination resulted in haemodynamically stable anaesthesia without the need for additional analgesics. Postoperative behavior was normal in all patients and none of the patients reported dreaming during or after operation. Propofol seems to be effective in eliminating side effects of a subanaesthetic dose of ketamine in humans

Study by J. Hwang, Y. Jeon, H.-P. Park, Y.-J. Lim and Y.-S. Oh[9] in 2005 in comparision of alfentanyl(PA) and ketamine(PK) in combination with propofol for patient controlled sedation during fiberoptic bronchoscopy found that, after sedation, systolic arterial pressure (SAP) decreased in the PA group, but SAP was stable in the PK group.

Study conducted by M. Koch, D. De Backer, J. L. Vincent*, L. Barvais, D. Hennart and D. Schmartz[10] in 2008 to know the effects of propofol on human microcirculation found that the 15 patients had a mean (range) age of 35 (25–41) yr. During the assessment of the microcirculation, the mean calculated propofol effect-site concentration was 6.5 micrograms/ ml (range 4.5–10 micrograms/ ml). There were no significant changes in heart rate or **S**pO2, but body temperature decreased during anaesthesia and the arterial pressure decreased at the end of the intervention.

Study by Fernando SF Cruz, Adriano B Carregaro, Alceu G Raiser, Marina Zimmerman,Rafael Lukarsewski and Renata PB Steffen[11] in 2010, to evaluate TIVA with propofol (P) alone or in combination with ketamine(PK) in rabbits undergoing surgery found that ketamine potentiates propofol-induced anesthesia in rabbits, providing better maintenance of heart rate

In a study conducted by Fernando Martinez-Taboada and Elizabeth A Leece[12]in 2014, to compare anaesthetic induction in 70 healthy dogs using propofol or ketofol(apropofol-ketamine mixture), following premedication, either propofol(10mg/ml) or ketofol(9mg propofol and 9mg ketamine/ml) was titrated intravenously until laryngoscopy and tracheal intubation were possible. Induction mixture volume (mean ± SD) was lower for ketofol (0.2 ± 0.1 mL kg^{-1}) than propofol (0.4 ± 0.1 mL kg^{-1}) ($p < 0.001$). PR increased following ketofol (by 35 ± 20 beats $minute^{-1}$) but not consistently following propofol (4 ± 16 beats $minute^{-1}$) ($p < 0.001$). Ketofol administration was associated with a higher mean arterial blood pressure (MAP) (82 ± 10 mmHg) than propofol (77 ± 11) ($p = 0.05$). Ketofol use resulted in a greater decrease in f_R (median (range): ketofol −32 (−158 to 0) propofol −24 (−187 to 2) breaths $minute^{-1}$) ($p < 0.001$). Sedation was similar between groups. Tracheal intubation and induction qualities were better with ketofol than propofol ($p = 0.04$ and 0.02 respectively).

Similar to the above studies, our study also had decrease in mean heart rate, mean systolic blood pressure, mean diastolic pressure, mean arterial pressure in propofol group when compared to propofol-ketamine combination group

There was a significant decrease in mean pulse rate statistically after propofol induction in propofol alone group after successive intervals i.e., 5,10,15,20,25,30 minutes was 72.9+/-5.24, 72.2+/-4.87, 72.3+/-5.42, 72.3+/-5.16, 72.7+/-4.89, 73.1+/-4.92 respectively,Mean basal pulse rate of propofol-ketamine group was 77.6+/-1.42. mean pulse rate at 5,10,15,20,25,30 intervals was 77.6+/-4.78, 77.5+/-5.10, 78.9+/-5.73, 77.4+/-5.29, 80.0+/-6.04, 78.6+/-5.49 respectively.

Our findings are similar to above studies.

Mean basal systolic blood pressure of propofol alone group was 118.4+/-9.36 and in propofol-ketamine group was 117.9+/-8.77 which were statistically comparable.

Decrease in mean systolic blood pressure was seen in propofol alone group, where maximum fall was noted at 5 minutes after induction (96.3+/-7.35) which was highly significant when compared to propofol-ketamine combination group through out 30 minutes of observation.

Similar fall of mean diastolic blood pressure was observed in propofol alone group from basal mean diastolic blood pressure (75.1+/-6.14). maximum drop was observed at 5 minutes after induction (60.9+/-3.54). Statistically significant difference was present between two groups throughout the 30 minutes observation.

Similar decrease in mean arterial pressure was noted in propofol alone group when compared to propofol-ketamine group,which was statistically significant.

In 40 patients who were posted for monitored anaesthesia care, Rosendo Mortero et al[13] (2001) from the University of Loursvilla, KY studied the effects of a small dose of ketamine on propofol in terms of sedation, respiration, post operative moodperception, cognition and pain. They concluded that co-administration of small dose ketamine attenuates propofol induced hypoventilation, produces positive mood effects without perceptual changes after surgery, and may provide earlier recovery of cognition.

In a study conducted by Fernando Martinez Taboada and Elizabeth A Leece[12]in 2014, to compare anaesthetic induction in 70 healthy dogs using propofol or ketofol(apropofol-ketamine mixture), following premedication, either propofol(10mg/ml) or ketofol(9mg propofol and 9mg ketamine/ml) was titrated intravenously until laryngoscopy and tracheal intubation were possible.Ketofol use resulted in a greater decrease in respiratory rate (median (range): ketofol −32 (−158 to 0) propofol −24 (−187 to 2) breaths minute^{-1}) ($p < 0.001$). Sedation was similar between groups.

Similar to the above study, our study also showed reduction in respiratory rate in propofol-ketamine combination group at 5,10,15 minutes when compared to propofol alone group which was statistically significant for some period(till 15 minutes), after that there was no significant difference between two groups.But there was no hypoventilation or apnoea.

Schuttler and Coworkers[14] did optimal dosage strategies in total intravenous anaesthesia using propofol-ketamine. 20 patients were scheduled for lower abdominal interventions. The patients were divided into two groups, anaesthesia was induced and maintained by a simple administration regimen and the second group received propofol and ketamine by microprocessor controlled infusion pumps and they concluded that TIVA with propofol and ketamine prove to be satisfactory from clinical point of view. The major side effect of propofol and ketamine disturbances were absent and respiratory function was adequate at the end of surgery.

Basal mean oxygen saturation values were comparable in both groups. Significant difference was present in mean oxygen saturation at 5 minutes in between two groups. There was no significant difference between two groups at 10,15,20,25,30 minutes.

According to the study conducted by Knox et al[15] in 1970, duration of anaesthesia with ketamine induction lasted for 13.2 +/- 1.25 minutes.

Duration of anaesthesia with ketamine induction lasted for 16-20 minutes in a study done by Dharet al[71] in 1983.

Diwale et al[16] study in 1983 showed that duration of anaesthesia with ketamine induction lasted for 5-17 minutes .

Time taken to recover from induction dose was noted in both groups. Mean time taken in propofol group was 2.63 minutes, where as in propofol-ketamine group 9.80 minutes, which was statistically significant.

Study conducted by M. Koch, D. De Backer, J. L. Vincent, L. Barvais, D. Hennart and D. Schmartz[10] in 2008 to know the effects of propofol on human microcirculation found that the 15 patients had a mean (range) age of 35 (25–41) yr. During the assessment of the microcirculation, the mean calculated propofol effect-site concentration was 6.5 micrograms/ ml (range 4.5–10 micrograms/ ml). There were no significant changes in heart rate or SpO2, but body temperature decreased during anaesthesia and the arterial pressure decreased at the end of the intervention.

Similar to the above study, Intra operatively hypotension was noted in 19 patients in propofol group. Venodilatory properties of propofol was responsible for hypotension in propofol alone group.

Hypertension was noted in 1 patient in propofol-ketamine group.

KaushikSahaet al[7] in 2001, compared fentanyl and ketamine, each with propofol for minor gynaecological procedures and they found excellent analgesia with ketamine 0.5mg/kg

Duration of pain relief was lesser in propofol alone group when compared to propofol-ketamine group. Propofol group required analgesics earlier than propofol-ketamine postoperatively. 33.33% in propofol group required analgesia in 0-1 hour post operatively, where as only 11% required analgesic dose in first postoperative hour. Propofol group needed higher analgesic requirements.

Mean time taken for first analgesic demand in propofol group was 8.6 +/- 1.89, where as in propofol-ketamine group 48.5 +/- 7.61 minutes.

Study was conducted by Sherry N. Rizk, Enas M. Samir[17] in 2013 regarding use of ketofol to control emergence agitation in children undergoing adenotonsillectomy in 90 children. They were randomly assigned to receive 10 ml of normal saline (control group, C) or, 1 mg/kg propofol in 10 ml saline (group P) or ketofol as 1 mg/kg propofol and 0.25 mg/kg ketamine in 10 ml saline (group K) 10 min before the end of surgery. In PACU, sedation, behavior, pain and severity of emergence delirium were assessed. Emergence delirium was significantly more frequent in the control group ($p < 0.001$), but comparable in ketofol and propofol groups. Ketofol provides a promising new option for controlling emergence agitation with adequate postoperative sedative and analgesic effect, good recovery criteria and hemodynamic stability compared to propofol and control groups in children undergoing adenoidectomy or adenotonsillectomy.

Similar to above study, emergence delirium was not observed in ketofol group. None of the patients experienced emergence delirium in our study.

VI. Conclusion

In the present study addition of ketamine in subanaesthetic doses as a coinduction agent to propofol is found to be an attractive alternative to propofol alone in ambulatory anaesthesiain providing better hemodynamic stability, less induction requirements of propofol in propofol-ketamine group (group PK) with less side effects when compared to propofol alone (group P). There was also significant difference in analgesic effect in between two groups. Duration of pain relief postoperatively was longer in group PK when compared to group P.

- Reduction in the induction dose of propofol in propofol-ketamine group in comparision with propofol group at low doses of ketamine in propofol-ketamine group.
- Better haemodynamic stability in propofol-ketamine group than propofol group.
- Time to recover from induction dose was prolonged in propofol-ketamine group.
- Less complications/side effects in propofol-ketamine group.

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