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Comparative Study of Propofol with Ketamine and Propofol with Butorphanol for Total Intravenous Anaesthesia in Short Surgical Procedures

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Abstract

Context: Maintaining hemodynamic stability, reducing pain on injection with Propofol and preventing PONV, in TIVA technique is a contentious subject and there is no perfect method to reduce it. *Aims:* To compare propofol with ketamine and propofol with butorphanol for total intravenous anesthesia in short surgical procedures. *Settings and design:* Hospital based study was carried out at SVS Medical College, Mahabubnagar. *Methods:* Total of 60 patients was studied. They were of either sex and the age ranged from 18-60 years. They had ASA-I & ASA-II grade. Two groups of patients were created randomly. Group K, received Propofol-Ketamine and Group B, Propofol Butorphanol. Both the groups were induced with Propofol 1.5 mg/kg IV and maintained with Propofol 9 mg/kg/hr IV. *Statistical analysis:* Chi square test and student's t test were used. *Results:* The SBP and DBP fell in both groups of patients after induction. SBP & DBP differed significantly during various intervals in patients who belonged to Group B. Such a significant difference was not found in group K. Pain on injection with Propofol was not attenuated by Butorphanol pre-treatment rather than Ketamine. Post-operative sedation was more in Group B (Propofol-Butorphanol) than in Group K (Propofol –Ketamine). Both the groups were found to be comparable in terms of post operative nausea and vomiting. *Conclusion:* "Propofol-Ketamine (Group K) combination" has been found to be more effective than the other group of patients who belonged to Group B in terms of stability of the hemodynamic parameters as well as sedation was lesser after surgery

Keywords: Propofol; Ketamine; Butorphanol; Intravenous; Procedures.

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Introduction

Various drugs are used for total intra-venous anesthesia. Each drug has a specific role. It has been expected that the anesthetic agent should be ideal in terms of rapid clearance; there should be minimum delay when we change the rate of infusion and its pharmacological action should be good. This has been expected because it favors patient recovery from anesthesia with minimum side effects. Total intravenous anesthesia is nowadays preferred over the inhalational anesthesia because it is possible

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to regulate the doses using Total intravenous anesthesia but difficult in the inhalational anesthesia. The components of TIVA can be regulated independently as the need for each component changes during surgery. Both somatic and autonomic responses to varying degrees of surgical stimulation can be controlled. Use of precision vaporizers can be avoided. Operation theatres remain unpolluted by trace concentrations of nitrous oxide or volatile anesthetic agents. Although the evidence is unclear or controversial, inhalation of these gases may cause bone marrow depression, an increase incidence of miscarriages in pregnant operating room personnel and a decrease in the alertness of the anesthesiologist's [1].

Virtually all intravenous anesthetic agents like Thiopentone, Methohexitone, Etomidate, Buprenorphine, Morphine etc., have been tried for TIVA but they have been abandoned because of their own drawbacks [2].

Propofol is one of the new agents and can be given intravenously. Its use is favorable for patients. It soon became very popular. In short duration operations, it is known to maintain anesthesia and good induction. Propofol is pleasant for most patients. It clears fast from blood. Hence, it is suitable for infusion. Fast recovery is the key of its action.

Ketamine is a water soluble IV anesthetic agent. It belongs to phencyclidine group. It is not only anesthetic but also hypnotic. It is also analgesic. It is cost effective also [3].

Neither Propofol nor Ketamine are suitable as sole anesthetic agents. The most common adjuvant is an opioid analgesic and this is sufficient to provide complete anaesthesia. On one side, ketamine increases the MAP and cardiac index and on the other side propofol reduces it [4].

Butorphanol, a synthetic opioid is used along with Propofol to provide analgesia. Butorphanol provides good analgesia but is associated with adverse effects like cardio depressant action, dizziness and sedation [5].

Hence, in this study we compared two drug regimens, i.e. Propofol-Ketamine and Propofol-Butorphanol for TIVA technique in patients undergoing short surgical procedures.

Materials and Methods

Source of Data

Sixty patients of SVS Medical College, Mahabubnagar, scheduled to undergo Elective short surgical procedures [less than 1 hour]; with physical status ASAI and ASAII, in the age group 18-60 years, of both sexes were randomly selected.

Institutional Ethics Committee permission was taken before the start of the study. Informed consent was obtained from the patients.

Inclusion criteria

1. Age 18-60 years
2. ASA grade I & II
3. Undergoing short duration surgeries
4. Willing to participate in the present study

Exclusion criteria

1. Patients who had requirement for muscle relaxants
2. Patients in whom it was difficult for mask ventilation
3. Having psychiatric disorder
4. Patients who were known cases of thyroid disease
5. Hypertensive patients
6. Patients with cardiac disease

Method of collection of data:

Design: The study included 60 patients randomly allocated into two groups.

Group K: 30 patients received Propofol-Ketamine combination

Group B: 30 patients received Propofol-Butorphanol combination.

Pre-anesthetic evaluation was carried out along with surgical profile.

All the patients were pre-medicated with injection Midazolam IV (0.01 mg/kg) 30 minutes before surgery. On arrival to the operation room an infusion line with 18 gauge cannula was started. Each patient was connected to NIBP, Pulse oximeter and ECG monitor.

Methods of collection of data

Anaesthesia was induced with Propofol-Ketamine in group K and with Propofol Butorphanol in group B with appropriate dosage according to body weight. Reading was collected from ECG, NIBP and pulse oximeter at regular intervals.

During the procedure of giving propofol,

pain was noted down. Simple pain monitoring parameters like withdrawal of the arm, grimace expression on the face, vocal response or presence of tears were observed and noted down.

Sedation was assessed in post-operative period using standard sedation score; Ramsay hunt sedation scoring was used. Incidence of PONV was noted.

Statistical analysis

Chi square test and student's t test were used.

Results

Table 1 shows age distribution in study groups. The age distribution in Ketamine group was 39.83 ± 10.75 yrs., and in Butorphanol group was 39.33 ± 10.67 years. When the 2 groups were compared, it was found to be statistically insignificant.

Table 2 shows sex Distribution in study groups. In Ketamine group, out of 30 patients, 14 (46.7%) were females and 16 (53.3%) were male patients. In Butorphanol group, out of 30 patients 15 (50%) were female and 15 (50%) were male patients. Both the groups were comparable.

Table 3 shows comparison of heart rate at various intervals in two groups. Base line heart rate in Ketamine group was 76.73 ± 4.94 and in Butorphanol group was 74.20 ± 4.96, both the groups were comparable statistically. On arrival in Ketamine group the mean heart rate was 77.80 ± 4.85 and in Butorphanol group it was 79.00 ± 7.62. Both the groups were comparable statistically. Mean heart rate at induction in Ketamine group was 78.13 ± 4.72 and in Butorphanol group, it was 73.00 ± 8.12, the differences were significant statistically. At 10 min the mean heart rate was 77.47 ± 4.81 in Ketamine group and it was 70.83 ± 6.59 in Butorphanol group. Difference in both the

Table 1: Age distribution in study groups

Groups	N	Mean age (years)	T value	p value
Group K	30	39.83 ± 10.75	0.1808	0.8571
Group B	30	39.33 ± 10.67		

Table 2: Sex Distribution in study groups

Sex	Group K		Group B		Chi square	p value
	Number	%	Number	%		
Female	14	46.7	15	50	0.065	0.398
Male	16	53.3	15	50		
Total	30	100	30	100		

Table 3: Comparison of heart rate at various intervals in two groups

Heart rate	Group K		Group B		T value	p value
	Mean	SD	Mean	SD		
Baseline	76.73	4.941	74.2	4.96	1.72	0.062
Arrival	77.8	4.852	79	7.62	0.727	0.47
Induction	78.13	4.725	73	8.12	2.991	0.004
10 Minutes	77.47	4.812	70.83	6.59	4.452	0.0001
20 Minutes	78.8	7.251	71.07	4.64	4.858	0.0001
30 Minutes	78.83	5.916	69.68	3.94	4.452	0.0001
40 Minutes	81.13	8.131	70.4	5.21	5.061	0.0001

Table 4: Comparison of systolic blood pressure (SBP) at various intervals in two groups

SBP	Group K		Group B		T value	p value
	Mean	SD	Mean	SD		
Baseline	132.8	14.293	135.67	13.309	0.804	0.425
Arrival	134.2	14.416	140.47	11.738	1.843	0.07
Induction	135.93	13.58	119.87	13.856	4.536	0.0001
10 Minutes	133.63	11.961	115.9	23.586	3.673	0.0001
20 Minutes	135.07	12.415	122.9	11.283	3.943	0.0001
30 Minutes	133.45	11.987	121.76	17.179	2.855	0.005
40 Minutes	133	11.14	126.6	14.35	1.603	0.113

groups was statistically significant. The mean heart rate at 20 minutes in Ketamine group was 78.80 ± 7.25 and in Butorphanol group was 71.07 ± 4.64; there was a significant difference when compared. At 30 minutes, the mean heart rate in Ketamine group was78.83 ± 5.91 and in Butorphanol group was 69.68 ± 3.94. The difference was statistically significant. At 40 minutes, the mean heart rate in Ketamine group was81.13 ± 8.13 and in Butorphanol group was 70.40 ± 5.21 this difference was highly significant.

Table 4 shows comparison of systolic blood pressure (SBP) at various intervals in two groups. The basal SBP in Ketamine group was 132.8 ± 14.29 mm of Hg and in Butorphanol group was 135.67 ± 13.30 mm of Hg. Both the groups were comparable statistically. On arrival, SBP in Ketamine group was 134.20 ± 14.41 mm of Hg and in Butorphanol group was 140.47 ± 11.78 mm of Hg. Both the groups were comparable statistically. SBP at induction in Ketamine group was 135.93 ± 13.58 and in Butorphanol group was 119.87 ± 13.85 mm of Hg. The difference in SBP in 2 groups was statistically highly significant with p value of 0.0001. SBP at 10 minutes in Ketamine group was 133.63 ± 11.96 mm of Hg and in Butorphanol group it was 115.90 ± 23.58 mm of Hg. The difference in SBP in 2 groups was statistically highly significant. SBP at 20 minutes in Ketamine group was 135.07 ± 12.41 mm of Hg and in Butorphanol group was 122.90 ± 11.28 of mm of Hg. The difference in SBP in 2 groups was statistically highly significant. SBP at 30 minutes in Ketamine group was 133.45 ± 11.98 and in Butorphanol group was 127.76 ± 17.17. The difference in SBP in 2 groups was statistically highly significant (p 0.0005). SBP at 40 min in Ketamine group was 133.00 ± 11.14 mm of Hg and in Butorphanol group was 126.60 ± 14.35 mm of Hg. The difference in SBP in 2 groups was statistically highly significant.

Table 5 show comparison of diastolic blood pressure (DBP) at various intervals in two groups The baseline DBP in Ketamine group was 82.2 ± 7.09 and in Butorphanol group was 80.57 ± 5.894. Both the groups were comparable statistically. DBP on arrival in Ketamine group was 81.47 ± 6.66 mm of Hg and in Butorphanol group was 82.53 ± 6.146 mm of Hg. Both the groups were comparable statistically. On induction DBP in Ketamine group was 80.67 ± 6.97 mm of Hg and in Butorphanol group was 68.93 ± 7.31 mm of Hg. The difference was statistically significant. DBP at 10 minutes in Ketamine group was 78.93 ± 5.21 and in Butorphanol group was 69.30 ± 5.82 mm of Hg. The difference in DBP was statistically highly significant. DBP at 20 min in Ketamine group was 80.13 ± 6.84 and in Butorphanol group was 71.52 ± 5.44 mm of Hg. The difference in 2 groups was significant statistically. DBP at 30 min in Ketamine group was 78.14 ± 6.04 mm of Hg and in Butorphanol was 74.24 ± 12.52 mm of Hg. The difference was not significant statistically. DBP at 40 min interval in Ketamine group was 77.64 ± 5.33 and in Butorphanol group was 73.9 ± 6.09 and it was statistically significant.

Table 6 shows comparison of Pain on injection with Propofol in two groups. In group K, out of 30 subjects studied, 17 patients experienced pain on injection with Propofol (56.7%). In group B, out of 30 subjects studied, 16 patients experienced pain on injection with Propofol (53.33%). There was

Table 5: Comparison of diastolic blood pressure (DBP) at various intervals in two groups

DBP	Group K		Group B		T value	P value
	Mean	SD	Mean	SD		
Baseline	82.2	7.092	80.57	5.894	0.970	0.336
Arrival	81.47	6.663	82.53	6.14	0.645	0.522
Induction	80.67	6.975	68.93	7.311	6.361	0.0001
10 Minutes	78.93	5.219	69.3	5.82	6.750	0.0001
20 Minutes	80.13	6.847	71.52	5.442	5.360	0.0001
30 Minutes	78.14	6.046	74.24	12.521	1.42	0.143
40 Minutes	77.64	5.332	73.7	6.146	2.218	0.031

Table 6: Comparison of Pain on injection with Propofol in two groups

Pain on injection	Group K		Group B		Chi square	P value
	Number	%	Number	%		
Absent	13	43.3	14	46.7	0.06622	0.3985
Present	17	56.7	16	53.3		
Total	30	100	30	100		

Table 7: Comparison of Post-operative sedation in two groups

Post operative sedation	Group K		Group B		Chi square	p value
	Number	%	Number	%		
Absent	19	63.3	13	43.3	1.674	0.098
Present	11	36.7	17	56.7		
Total	30	100	30	100		

Table 8: Incidence of PONV in two groups

PONV	Group K		Group B		Chi square	p value
	Number	%	Number	%		
Absent	24	80	22	73.3	0.093	0.3807
Present	6	20	8	26.7		
Total	30	100	30	100		

no statistically significant difference between the two groups.

Table 7 shows comparison of Post-operative sedation in two groups. In group K, out of 30 patients studied, 11 (36.7%) had postoperative sedation, whereas in Group B 17 (56.7%) had postoperative sedation. Though there was no statistically significant difference on comparison among 2 groups, it can be clearly inferred that prevalence of sedation was high in group B.

Table 8 shows incidence of PONV in two groups. In group K, out of 30 subjects studied, 6 subjects complained of PONV in post-operative period (20%). In group B, 8 subjects complained of PONV (26.7%). The two groups (23.3%) when compared, the incidence of PONV was not significant statistically.

Discussion

The availability of rapid and short acting sedative hypnotics, analgesics and muscle relaxants has refocused the attention on complete anesthesia by intravenous route. The advent of continuous infusion system has made administering TIVA all the more popular and convenient. But even today, we are still without any one intravenous drug that can alone provide all the requirements of anesthesia (i.e. unconsciousness, analgesia and muscle relaxation). Hence there is need to administer several different agents to produce the desired results. This in turn leads to important and significant drug interactions [6].

We studied two drug regimen; Propofol-Ketamine, (group-K) and Propofol-Butorphanol, (group B) for TIVA technique.

In the present study, from baseline to post induction 40 min, the hemodynamics did not change significantly in both the groups.

Dunnihoo and co-workers [7] found similar results.

In another study, Croizer and coworkers [8] compared the effect of TIVA with Ketamine-Propofol on hemodynamic, endocrine and metabolic stress response with Alfentanil-Propofol. Anesthesia was induced with 2 mg/kg Ketamine or 0.05 mg/kg Alfentanil, following by 1 mg/kg Propofol. Anesthesia was maintained with Propofol infusion at an initial rate of 15 mg/kg/hr which was reduced to 5 mg/kg/hr after 30 minutes. They found that combination of Propofol-Ketamine was hemodynamically stable throughout the surgery in comparison with Propofol-Alfentanil.

Furuya A et al. [9] observed and concluded from their study that for better hemodynamic stability, ketamine should be given before you give propofol. Similar results were given by Nalini KB et al. [10] and Turk HS et al. [11].

Mayer and coworkers [4] found that there was decrease in the HR and MAP with the use of propofol fentanyl combination.

Saha and coworkers [12] used propofol and fentanyl and found that SBP decreased significantly and also there was significant decrease in the HR.

A difference in incidence of sedation in two groups was noted. In Ketamine group the incidence was 36.7% where as in Butorphanol group the incidence was 56.7%.

A study, conducted by Sheppard [13] showed the effect of Ketamine and Propofol in terms of respiration, postoperative mood, perception and cognition. They concluded that, a mixture of Propofol and Ketamine provided hemodynamic stability during anesthesia and produced a positive mood state during recovery period without side effect. The combination also appeared to prompt early recovery of cognitive function.

This may be due to the fact that Propofol inhibits NMDA receptors in Hippocampus neurons, which may have contributed to the positive effect on mood. Sedative effects of Propofol are partially antagonized by arousal effect of Ketamine [13].

A comparison of recovery in patients receiving Fentanyl and Butorphanol was done by Wechler and coworkers [14] and they concluded that Butorphanol has longer recovery period. Similar results were given by Agrawal A et al. [15]

One major disadvantage of TIVA is PONV, which is the rate limiting factor in patient discharged from postoperative ward. In the present study, 20% patients from group K and 23.3% patients from group B had PONV. Wetchler BV et al. [14] and Regmi et al. [16] study results were in accordance with the present study findings.

Aasim SA et al. also stated that hemodynamic stability was better in patients in the propofol – ketamine group [17].

Conclusion

In conclusion, we found that Propofol-Ketamine (Group K) combination has the advantage of offering better hemodynamic stability and post-operative recovery in terms of sedation.

Key messages

Propofol-Ketamine (Group K) combination can be used for total intravenous anesthesia in short surgical procedure.

References

1. Robert FJ. Total intravenous anaesthesia. Anesthesiology. 1996;84:149 151.
2. Kay B. A comparative with Methohexitone and Alfentanil for major surgery. Anaesthesia. 1986; 41:589-595.
3. White PF, Way WL and Trevor AJ. Ketamine, its Pharmacology and Therapeutic uses. Anesthesiology. 1982;56:119–136.
4. Mayer M, Ochman O, Deonicke A, Angste JR and Suttam H. Influence of Propofol - Ketamine versus Propofol – Fentanyl anaesthesia in hemodynamics and analgesia. Anesthetist. 1990;39:609-16.
5. Heel RC, Brogda RN, Speight TM and Aveg GS. Butorphanol: are view of its Pharmacologic properties and Therapeutic efficacy. Drugs. 1978; 16:473-505.
6. Bailie R, Craig G and Restall J. Total intravenous anesthesia for laparoscopy. Anesthesia. 1989;44: 60-63.
7. Dunnihoo M. The effects of total intravenous anaesthesia using propofol, ketamine and vecuronium on cardiovascular response and wake up time. American Association of Nurse Anesthetists. 1994;62:396.
8. Croizer TA, Muller JE and Quittket D. TIVA with methoxital alfentanil or propofolalfentanil in laparotomy. Clinical aspect and effects of stress react ions. Anesthetist. 1994;33:594-604.
9. Furuya A, Matsukawa T, Ozaki M, Nishiyama T, Kume M, Kumazawa T. Intravenous Ketamine attenuates arterial pressure changes during the induction of anaesthesia with Propofol. Eur J Anaesthesiol. 2001 Feb;18(2):88-92.
10. KB Nalini, Cherian A, Balachander H, Kumar C Y. Comparison of Propofol and Ketamine versus Propofol and Fentanyl for Puerperal Sterilization, A Randomized Clinical Trial. Journal of Clinical and Diagnostic Research : 2014;8(5):GC01-GC04.
11. Aydogmuş M Unsal O Isıl CT Citgez B Oba S Turk J Gastroenterol. Turk HS et al. Ketamine versus alfentanil combined with Propofol for sedation in colonoscopy procedures: a randomized prospective study. 2014 Dec;25(6):644-9.
12. Saha K, Saigopal M and Sundar R. Comparative evaluation of propofol ketamine and propofol-fentanyl in minor surgery. Indian Journal of Anesthesia. 2001;45:100-103.
13. Mortero RF, Clark LD, Tolan MM and Metz RJ. The effects of small dose of Ketamine on Propofol sedation, respiration, postoperative mood, perception, cognition and pain. Anesthesia and Analgesia. 2001;92:1465-9.
14. Wetchler BV, Alexender CD and Shariff MS. A comparison of recovery in out-patient, receiving fentanyl versus those receiving Butorphanol. Journal of clinical Anaesthesia. 1989;5:339-43.
15. Agarwal A, Raza M, Dhiraaj S and Pandey R. Pain on injection of propofol: The effect of prior administration of Butorphanol. Anesthesia and Analgesia. 2004;99:117-9.
16. REGMI, Nabin Kumar; KHATRI, Santosh; DATTA, Prashanta Kumar. Comparison of Propofol-Ketamine Combination with Propofol-Butorphanol Combination for Total Intravenous Anaesthesia on Short Surgical Procedures. Journal of Nepalgunj Medical College. 2016 Feb;12(2):34-39.
17. Aasim SA, Syamasundara RB, Zubair SI. Comparison of Quality of Anaesthesia with Propofol Fentanyl and Propofol Ketamine as Total Intravenous Anesthesia Technique for Short Surgical Procedures. Journal of Chalmeda Anand Rao Institute of Medical Sciences. 2014;8(2):104-7.