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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

Background and Objective: Total intravenous anaesthesia currentlypracticed during short surgical process.Propofol due to its favourable pharmacokinetic profile is widely used in TIVA butlacks analgesic property, decreased cardiac index and pain on injection. To overcome these disadvantage we added ketamine in Group K and butorphanol in Group B for TIVA technique for comparative study. *Methods:* We studied 60 patients of either sex aged 18-60yrs of ASA-I and II grade, undergoing short surgical procedures less than one hour. They were randomly allocated into 2 groups, group K, receiving ketamine 1mg/kg and propofol 1.5mg/kg and group B received butorphanol 20 μg/kg and propofol 1.5mg / kg as inducing agent Anaesthesia was maintained with propofo l9mg/kg/hr via infusion pump in both group. Baseline, intra and postoperative haemodynamic parameters, sedation, postoperative nausea, vomiting were evaluated every 10min interval upto 40 minutes. Pain on injection with propofolwas also noted. Data recorded andanalysed by t-test, chi-square and F test. *Results and Observation:* Significant variation was observed in hemodynamic parameter in Group B whereas no statistically significant change in group K. The incidence of postoperative sedation was 36.7% in Group K whereas in group B it was 46.7%. Attenuation of pain on injection with propofol, was 23.3% in group B as compared with 56.7% in group K showing pain.There was no statistically significant difference in two groups regarding incidence of PONV. *Interpretation and conclusion:* We concluded thatPropofol-ketamine, offered better haemodynamic stability over propofol-butorphanol. Pain on injection was better attenuated by butorphanol. Post operative sedation was more with butorphanol. No significant difference in PONV between two groups.

Keyword: TIVA; Haemodynamic Stability; PONV.

Introduction

Total intravenous anaesthesia (TIVA) is currently practiced uses several types of drugs, each performing a specific role. The components of TIVA can be regulated independently as the needs 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 volatileanaesthetic agents, decreased oxygen consumption, avoids distension of air-filled spaces within the patient's body, thus producing optimum operating conditions for the surgeon, avoids postoperative diffusion hypoxemia, decreases the incidence of postoperative nausea and vomiting (PONV) [1].

Although the evidence is unclear or controversial, that inhalation of these gases may cause bone marrow depression, increase incidence of miscarriages in pregnant operating room personnel and a decrease in the alertness of the anesthesiologists [2].

Propofol achieved considerable popularity for induction and maintenance of anesthesia for short

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surgical procedure. It is pleasant for patients. It has a high clearance rate and rapid decline in blood concentration, making it eminently suitable for infusion. When propofol infusion is discontinued there is rapid recovery from anaesthetic state. Ketamine is the only intravenousanaesthetic which has hypnotic, analgesic and amnesic properties, maintain respiration and cheaper thanfentanyl and Butorphanol [3].

Neither propofol nor ketamine are suitable as sole anaesthetic agents. The most common adjuvant is an opioid analgesic and this is sufficient to provide complete anaesthesia. Propofol produces a reduction in both cardiac index and mean arterial pressure, in contrast, ketamine increases the same [4].

Butorphanol provides good analgesia but is associatedwith adverse effects like cardiodepressant action, dizziness and sedation [5]. Hence, in this study we investigate whether the combination of propofol-ketamine or propofol-butorphanol can give better haemodynamic stability during induction and maintenance of anaesthesia, along with the effect of abolishing pain on injection with propofol, postoperative sedation and postoperative nausea and vomiting.

Method and Material

The retrospectivestudy was carried out in Govt. Medical College, Kota after approval of hospital research and ethics committee. Sixty patientsof both sex, 18-60year, ASA I and II undergoing short surgical procedures of less than one hour, were randomly allocated into twogroups. Group K (n=30) received propofol-ketamine combination Group B(n=30 patients received propofol-butorphanol combination. Preanaesthetic evaluationwas done ,well informed consent was taken. Patients who required muscle relaxation, anticipated difficult mask ventilation, psychiatric disorders, thyroid disorder, hypertensive and with cardiac disease were not included in the study.

All the patients were premedicated with injection diazepam IV (0.1mg/kg) 30 minutes before surgery. On arrival to the operation room IV line was secured with 18G cannulae, then Inj. Ringer Lactae was started. Multiparameter monitor was attached NIBP, Pulse oximeter and ECG monitor were monitored and recorded at regular interval. Group K, received ketamine 1mg/kg and propofol 1.5mg/kg and group B received butorphanol 20 μg/kg and propofol 1.5mg /kg as inducing agent Anaesthesia was maintained with propofol 9mg/kg/hr via infusion pump in both group and titrated accordingly. Pain on injection with propofol was noted while injecting propofol, patients were continuously observed for vocal response, facial grimace arm withdrawal or tears suggesting pain. Sedation was assessed in postoperative period using standard sedation score, Ramsay hunt sedation scoring was used. Incidence of PONV was noted.

Result

The groups were compared with respect to age (Table 1) and sex (Table 2). Base line heart rate in Group K was 76.73± 4.94 and in Group B was 74.20± 4.96, on arrival in Group K 77.80± 4.85 and in Group B it was 79.00± 7.6 both the groups were comparable equally. Whereas statistically significant differences were found at induction (78.13 ± 4.72 & 73.00± 8.12), 10 min (77.47± 4.81 & 70.83± 6.59), 20 min (78.80± 7.25 & 71.07± 4.64), 30 min (78.83 ± 5.91 & 69.68 ±3.94). At 40minutes in Group K the mean heart was 81.3±8.13 in Group B 70.40± 5.21 was highly significant (Table 3).

The basal SBP was 132.8±14.29mm Hg and 135.67± 13.30mm Hg in Group K and Group B respectively which were statistically comparable. On arrival in Group K SBP was 134 ±20 14.41mmHg and in Group B it was 140.47± 11.78mmHg which were statistically comparable. At induction it was 135.93±13.58 and 119.87±13.85mm of Hg respectively, with p value of 0.0001. It was also highly significant at 10, 20 min interval with p value of 0.0001. SBP was 133.45 ± 11.98 and 133.00 ±11.14mm Hg in Group K and 127.76±17.17 and 126.60± 14.35mm Hg in Group B at 30min and 40min interval respectively which was highly significant statistically (Table 4).

Basal DBP was 82.2 ±7.09 in Group K and 80.57± 5.894 in Group B which was statistically comparable. Both groups were also comparable on arrival with p value of 0.522. Like SBP, changes in DBP in both groups were also highly significant with p value of 0.0001 at. 10, 20 min interval . It was 78.14 ± 6.04mm Hg in Group K and 74.24± 12.52 mm Hg in Group B at 30 min interval. The difference was not significant statistically. It was 77.64± 5.33 and 73.9 ± 6.09 in Group K and Group B respectively which was statistically significant at 40min interval (Table 5).

In Group K 17 (56.7%) patients and in Group B only (23.3%). experienced pain on injection with propofol (Table 6) .

The incidence of PONV are more in Group B (26.7%). patients as compared to Group K (20%)., but

statistically not significant (Table 7).

The prevlance of postoperative sedation was more in Group B 17(56.7%) as compared to group K, 11 (36.7%) Though there was no statistically significant difference on comparison among two groups (Table 8).

Table 1: Age distribution

	N	Mean age	St. deviation
Group K	30	39.8333	10.75778
Group B	30	39.333	10.67169

Table 2: Sex distribution

Sex	Group K	Group B	Total
Female	14 (46.7%)	15 (50.0%)	29 (48.3%)
Male	16 (53.3%)	15 (50.0%)	31 (51.7%)

Table 3: Intergroup comparison of HR at various time intervals

Period	Group	N	Minimum	Maximum	Mean	Std. Deviation	
Baseline	K	30	70	86	76.73	4.94	t(58)=1.72
	B	30	64	86	74.20	4.965	P = 0.0.62ns
Arrival	K	30	70	88	77.80	4.852	t(58)=0.727
	B	30	66	94	79.00	7.625	P=0.47ns
Induction	K	30	70	88	78.13	4.725	t(58)=2.991
	B	30	60	92	73.00	8.128	P=0.004hs
10min	K	30	70	86	77.47	4.812	t(58)=4.452
	B	29	60	84	70.83	6.592	P=0.0001hs
20min	K	30	70	100	78.80	7.251	t(57)=4.858
	B	29	60	78	71.07	4.644	P=0.0001hs
30min	K	29	68	90	78.83	5.916	t(52)=4.452
	Bl	25	62	78	69.68	3.945	P=0.0001hs
40min	K	23	68	96	81.13	8.131	t(41)=5.061
	B	20	60	84	70.40	5.215	P=0.0001hs

Table 4: Intergroup comparison of changes in Systolic BloodPressure (SBP)

Period	Group	N	Minimum	Maximum	Mean	Std. Deviation	
Baseline	K	30	110	160	132.80	14.293	t(58)=0.804
	B	30	110	158	135.67	13.309	P = 0.425ns
Arrival	K	30	110	160	134.20	14.416	t(58)=1.843
	B	30	110	160	140.47	11.788	P=0.070ns
Induction	K	30	100	168	135.93	13.580	t(58)=4.536
	B	30	100	142	119.87	13.856	P=0.0001hs
10min	K	30	110	156	133.63	11.961	t(58)=3.673
	B	30	11	140	115.90	23.586	P=0.0001hs
20min	K	30	110	154	135.07	12.415	t(58)=3.943
	B	29	106	140	122.90	11.283	P=0.0001hs
30min	K	29	110	156	133.45	11.987	t(58)=2.855
	B	25	70	156	127.76	17.179	P=0.005hs
40min	K	22	116	150	133.00	11.140	t(58)=1.603
	B	20	106	150	126.60	14.350	P=0.113hs

Table 5: Intergroup comparison of changes in Diastolic Blood Pressure (DBP)

Period	Group	N	Minimum	Maximum	Mean	Std. Deviation	
Baseline	K	30	110	160	132.80	14.293	t(58)=0.804
	B	30	110	158	135.67	13.309	P = 0.425ns
Arrival	K	30	110	160	134.20	14.416	t(58)=1.843
	B	30	110	160	140.47	11.788	P=0.070ns
Induction	K	30	100	168	135.93	13.580	t(58)=4.536
	B	30	100	142	119.87	13.856	P=0.0001hs
10min	K	30	110	156	133.63	11.961	t(58)=3.673
	B	30	11	140	115.90	23.586	P=0.0001hs

20min	K	30	110	154	135.07	12.415	t(58)=3.943
	B	29	106	140	122.90	11.283	P=0.0001hs
30min	K	29	110	156	133.45	11.987	t(58)=2.855
	B	25	70	156	127.76	17.179	P=0.005hs
40min	K	22	116	150	133.00	11.140	t(58)=1.603
	B	20	106	150	126.60	14.350	P=0.113hs

Table 6: Comparison of Pain on injection with propofol

POI	Group K	Group B	Total
Absent	13	23	36
	43.3%	76.7%	60.0%
Present	17	7	24
	56.7%	23.3%	40.0%

Table 7: Incidence of PONV

PONV	Group K	Group B	Total
Absent	24	22	46
Present	80.0%	73.3%	76.7%
	6	8	14
	20.0%	26.7%	23.3%

Table 8: Comparison of Postoperative sedation

POS	Group K	Group B	Total
Absent	19	13	32
Present	63.3%	43.3%	53.3%
	11	17	28
Total	36.7%	56.7%	46.7%
	30	30	60
	100.0%	100.0%	100.0%

Discussion

Total intravenous anaesthesia (TIVA) is a technique in which induction and maintenance of anaesthesia is achieved with intravenous drugs alone; avoiding both volatile agents and nitrous oxide. In this process, the patients either breathe spontaneously or are artificially ventilated with oxygen [6].

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 (egthiopentone, propofol) but was associated with side effects. Hence there is need to administer several different agents to produce the desired results. This in turn leads to important and significant drug interactions [7].

We studied two drug regimen; propofol-ketamine, (Group-K) and propofol-butorphanol, (Group B). In our study with group K, there was no statistically significant change in heart rate, systolic blood pressure and diastolic blood pressure during post induction and maintenance of anaesthesia throughout the procedure when compared to group B for TIVA technique.

A similar study was done by Dunnihoo and co - workers using Propofol-ketamine on cardiovascular response and wake up time. They showed that this combination maintained better haemodynamic stability and there was no significant change in heart rate and arterial blood pressure throughout the procedure [8].

In another study, Croizer and coworkers compared the effect of TIVA with ketamine-propofol on haemodynamic, endocrine and metabolic stress response with alfentanyl-propofol. They found that combination of propofol-ketamine was haemodynamically stable throughout the surgery in comparison with propofolalfentanil [9].

In the present study in group B, basal, post induction and intraoperative haemodynamic variables were analysed and found that there was statistically significant decrease in heart rate and systolic blood pressure and diastolic blood pressure after induction and during maintenance phase of anaesthesia.

Saha and coworkers conducted a randomized double blind study to evaluate the efficiency of combination of propofol-ketamine and propofol-fentanyl in 60 patients undergoing minor surgery. They showed that significant decrease in heart rate after induction and maintenance of anaesthesia with propofol and fentanyl. A significant decrease in systolic blood pressure was also observed [10].

Propofol a modern intravenous hypnotic produces a reduction in both cardiac index (C.I) and mean arterial pressure (MAP). Ketamine a potent analgesic in contrast causes an increase in mean arterial blood pressure and cardiac index, the single dose of ketamine during induction of anaesthesia was enough to neutralize the cardiodepressant effect of propofol. During the maintenance of anaesthesia there was better haemodynamic stability in ketamine group than in butorphanol group. Butorphanol intensified the fall in arterial blood pressure after propofol induction and patients in this group were more sedated.

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%. Sedative effects of propofol are partially antagonized by arousal effect of ketamine. A comparison of recovery in patients receiving fentanyl and butorphanol was done by Wechler and coworkers and they concluded that butorphanol has longer recovery period [11].

Incidence of pain was 23.3% in group B, where as in ketamine group it was 56.7%. This is consistent with study done by Agarwal and coworkers, where they found that simple and effective method of attenuatatingpropofol induced pain is with pretreatment by butorphanol [12].

One major disadvantage of TIVA is PONV, which is the rate limiting factor in patient discharged from postoperative ward. In our study, the incidence of PONV in group K was 20.0% where as in group B it was 23.3%. The difference between the 2 groups was statistically insignificant.

These results are similar to a study by Wetchler and group where they found that there was no difference in incidence of PONV between butorphanol and fentanyl when used as pre-induction agent.

We concluded, that Propofol-ketamine (Group K) combination has the advantage of offering better hemodynamic stability and postoperative recovery in terms of sedation. Attenuation of pain on injection was the only added advantage of propofol–butorphanol (Group B) combination. There was no difference in the incidence of PONV with both drugs.

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