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Comparative Study between Total Intravenous Anaesthesia Using 'Ketamine – Propofol' And 'Fentanyl – Propofol' For Day Care Procedures.

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Abstract

Background: Day care surgery is among the most important trends in anesthesia and health care in last few decades.

Aims and Objective: To compare between total intravenous anaesthesia using 'ketamine – Propofol' and 'fentanyl – Propofol' for day care procedures.

Material And Method: The present study carried out in the Department of Anesthesiology, Geetanjali hospital Udaipur during the period January 2014 to January 2015 on 50 patients with ASA Grade I and II posted for short surgical procedure coming to the Department of surgery RNT Medical College, Udaipur.

Conclusion: Both fentanyl (2.0µg/kg) and ketamine (0.5 mg/kg) are good analgesics for total intravenous anaesthesia in combination with Propofol.

Keywords: Day Care Surgery, Fentanyl, Ketamine, Propofol.

Introduction: Day care surgery is among the most important trends in anesthesia and health care in last few decades.

Most of the surgeries are conducted under balanced anesthesia which includes sedation, amnesia, analgesia and muscle relaxation. This can be achieved by combining various intravenous and inhalational agents. But this technique becomes expensive, needs special apparatus like vaporisers and also may prolong the recovery and discharge of patient[1] along with their depressant cardiac and respiratory effects.Intravenous anesthetic agents provide rapid and smooth induction over last couple of decades the growth in knowledge or pharmacokinetics and pharmacodynamics of intravenous anesthetic agents has resulted in better understanding of the relationship between drug dose, blood concentration and effect.[2, 3]

❖ **Ideal intravenous agent should have following properties**

- Rapid and smooth induction.
- Should cause no or minimal depression of respiratory and circulatory system.
- Should provide profound analgesia.
- Should spare protective laryngeal reflexes.
- Should have short duration of action with no residual effects.
- Cost effectiveness.

Propofol as a result of its favorable pharmacokinetics and pharmacodynamics [4, 5,6] has become an ideal agent for

induction and maintenance of anesthesia for short surgical procedures. Along with hypnotic and sedative properties Propofol has got unique mood elevating and anti-emetic property. Induction with Propofol is rapid and smoother compared to methohexitol and inhalational agents. Amongst opioids newer potent short acting drugs like fentanyl,[7] sufentanil, alfentanil[8] are agents of choice for anesthesia with Propofol, with adequate analgesia and rapid recovery. Also, ketamine in sub-anesthetic doses[9] is known to produce minimum cardio respiratory depression while providing intense analgesia. Combination of ketamine with Propofol and midazolam can minimize its cardiovascular stimulating and psychomimmetic effects. [10]

AIM: To compare between total intravenous anaesthesia using 'ketamine – Propofol' and 'fentanyl – Propofol' for short surgical procedures.

Objectives: To study and compare:

- Changes in heart rate
- Changes in respiratory rate
- Changes in oxygen saturation
- Recovery time – Time required for eye opening by patient after infusion is stopped either spontaneously or on verbal command
- Postoperative pain by verbal pain scale.
- Side effects like emergence delirium and postoperative nausea and vomiting.

Material and methods

The present study was carried out in the Department of Anesthesiology Geetanjali hospital Udaipur during the period January 2017 to January 2018 on 50 patients with ASA Grade I and II posted for short surgical procedure coming to the Department of Surgery Geetanjali hospital Udaipur.

Study Design: The present study was a prospective, interventional and observational study.

Study Period: From January 2017 to January 2018.

Study Population: All the patients coming to the Department of Surgery of Geetanjali hospital Udaipur for short surgical procedures to be performed.

A total of 25 patients per group were included in the study.

Group '1' (N=25): ketamine 0.5 mg/ Kg with propofol induction and maintenance.

Group '2' (N=25): Fentanyl 2 µg / Kg with propofol for induction and maintenance.

Result

Table No. 1: Distribution of patients according to groups (N=50)

Group	Number	Percentage
Ketamine Group	25	50.0
Fentanyl Group	25	50.0
Total	50	100.0

Table No. 2: Distribution of patients according to gender (N=50)

Group	Number	Percentage
Male	4	4.0
Female	48	96.0
Total	50	100.0

Table No. 3: Comparison of mean age (years) between the two study groups

(N=50)

Parameter	Ketamine Group (Mean±SD) (n=25)	Fentanyl Group (Mean±SD) (n=25)	't' Value, df	P value
Age	34.08 ± 9.57	31.96 ± 8.82	0.814, df=48	0.410, NS

Unpaired 't' test applied. P value < 0.05 was taken as statistically significant

Table No. 4: Comparison of mean duration of surgery (min) between the two study groups

(N=50)

Parameter	Ketamine Group (Mean±SD) (n=25)	Fentanyl Group (Mean±SD) (n=25)	't' Value, df	P value
Duration of surgery (min)	28.96 ± 5.47	28.36 ± 4.63	0.419, df=48	0.670, NS

Unpaired 't' test applied. P value < 0.05 was taken as statistically significant

Table no.5: Comparison of time, place and person orientation time (seconds) between the two study groups (N=50)

Parameter	Ketamine Group (Mean±SD) (n=25)	Fentanyl Group (Mean±SD) (n=25)	't' Value, df	P value
Orientation time	662.40 ± 154.90	935.20 ± 85.10	-7.72, df=48	0.000*

Unpaired 't' test applied. P value < 0.05 was taken as statistically significant

Table No. 6: Comparison of occurrence of side effects between the two study groups

Side effects		Study Groups: Ketamine Group (N = 25)	Study Groups: Fentanyl Group (N = 25)	Total
Nausea / vomiting	N	1	5	6
	%	4.0%	20.0%	12.0%
Z test for 2 sample proportion, Z value = -1.80, P value =0.072, Not significant				
Visual disturbances	N	1	0	1
	%	4.0%	0.0%	2.0%
Z test for 2 sample proportion, Z value = 1.02, P value =0.307, Not significant				
Emergence delirium	N	4	0	4
	%	16.0%	0.0%	8.0%
Z test for 2 sample proportion, Z value = 2.18, P value =0.029, Significant				
Injection Pain	N	10	13	23
	%	40.0%	52.0%	46.0%
Z test for 2 sample proportion, Z value = -0.86, P value =0.391, Not significant				

Table No. 7

Comparison of Mean Heart Rate at different points of time between the two study groups (N=50)

Mean Heart Rate	Study Groups	N	Mean ± SD	't' Value, df	P value
Pre-op	Ketamine group	25	87.0 ± 9.3	1.50, df=48	0.140. NS
	Fentanyl group	25	83.7 ± 6.0		
Intra-op 1 min	Ketamine group	25	91.5 ± 8.4	0.853, df=48	0.398, NS
	Fentanyl group	25	89.0 ± 12.2		
Intra-op 5 min	Ketamine group	25	93.3 ± 8.6	-0.197, df=48	0.845, NS
	Fentanyl group	25	93.9 ± 13.8		
Intra-op 10 min	Ketamine group	25	92.6 ± 9.1	-1.646, df=48	0.106, NS
	Fentanyl group	25	97.6 ± 12.0		
Intra-op 20 min	Ketamine group	25	90.5 ± 8.2	-4.640, df=48	0.000*
	Fentanyl group	25	102.8 ± 10.5		
Intra-op 30 min	Ketamine group	11	88.9 ± 8.2	-2.399, df=22	0.025*
	Fentanyl group	13	98.8 ± 11.4		
Intra-op 40 min	Ketamine group	2	86.0 ± 2.8	-	-
	Fentanyl group	0	0.00 ± 0.0		
Post-op 5 min	Ketamine group	25	86.5 ± 5.8	-3.719, df=48	0.001*
	Fentanyl group	25	92.7 ± 6.1		
Post-op 10 min	Ketamine group	20	86.0 ± 5.9	-2.085, df=43	0.043*
	Fentanyl group	25	89.5 ± 5.4		
Post-op 15 min	Ketamine group	1	78.0 ± 0.0	-	-
	Fentanyl group	3	86.0 ± 8.7		

* Statistically significant difference (P<0.05)

Table No. 8: Comparison of Mean Respiratory Rate at different points of time between the two study groups

(N=50)

Systolic Blood Pressure	Study Groups	N	Mean ± SD	't' Value, df	P value
Pre-op	Ketamine group	25	13.2 ± 1.3	0.779, df=48	0.440, NS
	Fentanyl group	25	12.9 ± 1.4		
Intra-op 1 min	Ketamine group	25	13.4 ± 5.0	2.265, df=41	0.029*
	Fentanyl group	18	9.8 ± 5.6		
Intra-op 5 min	Ketamine group	24	15.8 ± 5.4	1.258, df=39	0.216, NS
	Fentanyl group	17	13.4 ± 7.0		
Intra-op 10 min	Ketamine group	25	18.0 ± 5.1	0.481, df=43	0.633, NS
	Fentanyl group	20	17.3 ± 5.9		
Intra-op 20 min	Ketamine group	25	20.3 ± 2.3	-2.950, df=37.95	0.005*
	Fentanyl group	25	23.1 ± 4.1		
Intra-op 30 min	Ketamine group	11	19.8 ± 3.2	-1.132, df=22	0.270, NS
	Fentanyl group	13	21.2 ± 3.0		
Intra-op 40 min	Ketamine group	2	17.0 ± 1.4	-	-
	Fentanyl group	0	0.00 ± 0.0		
Post-op 5 min	Ketamine group	25	16.2 ± 1.8	-3.283, df=48	0.002*
	Fentanyl group	25	18.4 ± 2.8		
Post-op 10 min	Ketamine group	20	14.6 ± 1.5	-4.108, df=43	0.000*
	Fentanyl group	25	16.4 ± 1.6		
Post-op 15 min	Ketamine group	1	14.0 ± 0.0	-	-
	Fentanyl group	3	17.7 ± 1.5		

* Statistically significant difference (P<0.05)

Table No. 9: Comparison of Mean Oxygen Saturation at different points of time between the two study groups

(N=50)

Systolic Blood Pressure	Study Groups	N	Mean ± SD	't' Value, df	P value
Pre-op	Ketamine group	25	99.8 ± 0.4	-0.210, df=48	0.835, NS
	Fentanyl group	25	99.8 ± 0.3		
Intra-op 1 min	Ketamine group	25	98.2 ± 1.4	6.200, df=48	0.000*
	Fentanyl group	25	95.8 ± 1.3		
Intra-op 5 min	Ketamine group	25	97.8 ± 1.9	2.772, df=48	0.008*
	Fentanyl group	25	95.8 ± 2.9		
Intra-op 10 min	Ketamine group	25	97.8 ± 1.3	1.282, df=48	0.206, NS
	Fentanyl group	25	97.3 ± 1.7		
Intra-op 20 min	Ketamine group	25	98.1 ± 1.1	2.251, df=48	0.029*
	Fentanyl group	25	97.4 ± 1.3		
Intra-op 30 min	Ketamine group	11	98.5 ± 0.7	1.568, df=22	0.131, NS
	Fentanyl group	13	97.8 ± 1.3		
Intra-op 40 min	Ketamine group	2	99.5 ± 0.7	-	-
	Fentanyl group	0	0.00 ± 0.0		
Post-op 5 min	Ketamine group	25	98.9 ± 0.6	4.125, df=48	0.000*
	Fentanyl group	25	98.0 ± 1.0		
Post-op 10 min	Ketamine group	20	99.2 ± 0.4	3.779, df=43	0.001*
	Fentanyl group	25	98.6 ± 0.7		
Post-op 15 min	Ketamine group	1	99.0 ± 0.0	-	-
	Fentanyl group	3	98.7 ± 0.6		

* Statistically significant difference (P<0.05)

Discussion

Day care surgery – anaesthesia' is now an established trend in field of anaesthesia; and can be accomplished by regional or general anaesthesia with or without inhalational agents.

Major determinants or successful outcome in out-patient anaesthesia are:

Proper patient selection, Smooth induction, Smooth intraoperative course with maintained haemodynamic and respiratory stability, Rapid and good quality recovery with minimal adverse events.

All of above characteristics can be fulfilled by total intravenous anaesthesia using different combinations of various drugs.

In present study, we used propofol as main induction and maintenance agent in combination with ketamine (Group 1) and fentanyl (Group 2).

There were no statistically significant differences in two groups regarding age (P=0.410) and weight (P=0.790) of patients.

Group 1 received inj. ketamine 0.5 mg/kg followed by inj. Propofol 2mg/kg while Group 2 was given inj. Fentanyl 2µg/kg followed by inj. propofol 2mg/kg.

In both groups, anaesthesia was maintained with inj. Propofol infusion at 9mg/kg/hr along with top-up doses of ketamine 5mg (Group 1) or 10 µg fentanyl (Group 2).

At the end of surgery infusion was stopped and early recovery period was noted till eye opening of patient; after which patient was immediately transferred to recovery room.

Respiratory and haemodynamic stability was assessed by observing pulse rate, systolic, diastolic and mean blood pressure, respiratory rate and oxygen saturation.

There was statistically no significant difference in duration of surgery between two groups (p=0.670).

Changes in heart rate

Preoperatively, mean heart rate in ketamine group was (mean 87.0 ± 9.3 S.D.) and in fentanyl group it was (mean 83.7 ± 6.0 S.D.) The difference was statistically insignificant (p=0.140).

There were no significant changes in heart rate at induction or at 5 mins and 10 min after that.

But at 20 mins after induction fentanyl group showed increase in heart rate (mean 102.8 ± 10.5 S.D.) which was statistically significant (p=0.00) compared to ketamine group (mean 90.5 ± 8.2 S.D.).

The increase in heart rate in fentanyl group persisted at 30 mins (mean 98.8 ± 11.4 S.D.) and at 10 mins in early recovery also (mean 89.5 ± 5.4 S.D.).

This difference though small, was significant compared to ketamine group at 30 mins post induction (mean 88.9 ± 8.2 S.D.) (p=0.001) and at 10 mins in early recovery (mean 86.0 ± 5.9 S.D.) (p=0.043).

Ghatak et al (2012)[11] in their study also found that heart rate were maintained in ketamine than with fentanyl or saline group.

Changes in Respiratory rate

In ketamine group preoperative mean respiratory rate was (mean 13.2 ± 1.3 S.D.) while in fentanyl group it was (mean 12.9 ± 1.4 S.D.). The difference was statistically not significant (p=0.440).

At 1 min after induction respiratory rate remained stable in ketamine group (mean 13.4 ± 5 S.D.) while fentanyl group had a significant fall in respiratory rate (mean 9.8 ± 5.6 S.D.) (P: 0.029, statistically significant).

The mean respiratory rate showed recovery in fentanyl group at 5 mins (mean 13.4 ± 7.0 S.D.) while increase in rate at 20 mins (mean 23.1 ± 4.1 S.D.). This increase in respiratory rate was higher than that in ketamine group (mean 20.3 ± 2.3) and statistically significant (p=0.005).

In postoperative early recovery period both groups had respiratory rate above the preoperative level and this increase was higher in fentanyl group (mean 18.4 ±2.8 S.D.) than ketamine group (mean 16.2 ± 1.8 S.D.) at 5 mins (p=0.002, significant). Respiratory rate returned more towards normal at 10 mins in early recovery in both groups: (fentanyl: mean 16.4 ± 1.6 S.D.) and ketamine (mean 14.6 ± 1.5 S.D.). Respiratory rate remained stable and near normal in recovery room also.

11 patients in fentanyl group had apnea in Intraoperative period after induction while only one patient in ketamine group had apnea.

Akin et al (2005)[12] also found similar results. In their study, in fentanyl group 5 out of 20 patients had apnea in

comparison to 1 out of 20 in ketamine group.

Changes in oxygen saturation

In our study, mean preoperative O_2 saturation in ketamine group was (99.8 mean ± 0.4 S.D.) and in fentanyl group (99.8 mean ± 0.3 S.D.) (P: 0.835). This difference was statistically not significant.

At one min after induction there was a fall in saturation in fentanyl group (mean 95.8 ±1.3 S.D.), which was higher compared to that in ketamine group (mean 98.2 ± 1.4 S.D.); the difference was statistically significant (p=0.00).

Similar fall in saturation was also present at 5 mins in both groups: ketamine (mean 97.8 ± 1.9 S.D.) and fentanyl (mean 95.8 ± 2.9 S.D.) (p=0.008, statistically significant.)

At 20 min, oxygen saturation improved in both groups. Still, it was higher in ketamine group (mean 98.1 ± 1.1 S.D.) than fentanyl group (mean 97.4 ± 1.3 S.D.) which was statistically significant (p: 0.029).

Oxygen saturation was stable at 30 mins in both groups: ketamine (mean 98.5 ± 2.9 S.D.); fentanyl (mean 97.8 ± 1.3 S.D.)(p=0.131) statistically not significant).

In early recovery period O_2 saturation in both groups was normal in both groups but still it was higher in ketamine group (mean 98.9 ± 0.6 S.D.) than fentanyl group (mean 98.0 ± 1.0 S.D.)(p: 0.00)(Statistically significant) at 5 mins.

O_2 saturation remained normal throughout the period in recovery room in both groups.

Hosseinzadeh et al (2013)[13] also noted not significant changes in SaO2 in ketofol group.

Time required for orientation in time place and person:

It was longer in fentanyl group (mean 935.20 ± 85.10 S.D.) than in ketamine group (mean 662.40 ± 154.90 S.D.) the difference being statistically significant (p=0.00).

Saha et al (2001)[14] found the recovery time (patients fully conscious and oriented to time, place and person) in Group I (mean 11.71 ± 7.17 min) was longer than in Group II (mean 8.7 ± .3.28 min), and the difference was statistically significant.

Recovery of intellectual function as examined by **digit span scale** also had better results in ketamine group (mean 8.9 ± 0.17 S.D.) than in fentanyl group (mean 7.74 ± 1.25 S.D.) (p=0.00, statistically significant).

Akin et al (2005)[12]also found that recovery profile in ketamine group was much better than fentanyl group, with a lesser mean discharge time in ketamine group (71.2 ± 5.7 min) in comparison to fentanyl group (115.2 ± 25.6 min). The difference was statistically significant (P<0.05).

Side Effects

Postoperative pain

In our study, in recovery room incidence of pain as assessed by verbal pain scale was higher in ketamine group (56.0% patients having mild pain and one patient having moderate pain) while only 38% patients in fentanyl group had mild pain with no complaints of moderate pain by any patient. This difference was statistically significant (p=0.014).

Vallejo et al (2002)[15]also found higher pain score in ketamine group (P<0.05) than fentanyl group with higher analgesia requirement.

Nausea and vomiting

In this study incidence or nausea and / or vomiting was 4% (1 in 25) in ketamine group which was lower than 20% (4 in 25) in fentanyl group. However the difference is statistically not significant. (p=0.082).

Akin et al (2005)[12]in their study had found higher incidence of nausea in ketamine group (P<0.5).

Conclusion

Findings in our study suggest that

1. Both fentanyl (2.0µg/kg) and ketamine (0.5 mg/kg) are good analgesics for total intravenous anaesthesia in combination with Propofol.

2. Ketamine - Propofol combination provides excellent hemodynamic and respiratory stability than fentanyl - Propofol.

3. Awakening from anaesthesia is faster with ketamine - Propofol than fentanyl -Propofol.

4. Incidence or side effects like emergence delirium is associated with ketamine while incidence or nausea and vomiting is higher in Fentanyl group.

5. Postoperative pain is significantly low in Fentanyl - Propofol group.

6. Ketamine - Propofol combination is having better 'cardio respiratory stability and recovery profile' than fentanyl - Propofol in short surgical procedures.

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