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Comparative Study of Total Intravenous Anaesthesia Using Propofol with or without Sufentanil in Laparoscopic Cholecystectomies

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Abstract

Background: Total intravenous anaesthesia (TIVA) is a ideal substitute to inhalation anaesthesia because of hemodynamic complications. TIVA with suitable combination of anaesthetic drugs will have good post-operative results.

Method: 60 patients aged between 18 to 65 years undergoing laparoscopic cholecystectomies were studied. Sixty patients classified in three groups, 20 patients in each group. GroupsS1 and S2 received propofol with sufentanil added at 1µgml and 2 µg ml concentration respectively while group P received propofol without sufentanil. Additional sufentanil boluses (10 µg) were when there is an increase in the hemodynamic parameters, recovery times, and post-operation analgesia g were compared in all three groups of patients.

Results: Hemodynamic parameters (HR, SBP, DBP) were not significantly different in all three groups. Fewer S2 patients required additional sufentanil boluses to maintain proper hemodynamic status. S2 group had better post-operative analgesia ($p<0.001$) but prolonged recovery time as compared to other two groups.

Conclusion: Sufentanil mixed with propofol provides better hemodynamic stability in laparoscopic cholecystectomies where more chances of pneumothoraxdue to fluctuations in hemodynamic parameters which may lead to morbidity and mortality.

Keywords: TIVA, propofol, sufentanil, Bolus, Hemodynamic

Introduction

General Anaesthesia should provide quick and pleasant induction, predictable loss of consciousness, stable operating conditions, minimal adverse effects, rapid and smooth recovery of protective reflexes and psychomotor function. Total intravenous anaesthesia (TIVA) is an evolved concept of general anaesthesia, which obviates the need for volatile anaesthetics. Propofol, a sedative – hypnotic agent with excellent recovery characteristics at the end of infusion and additional anti-emetic property, has become the drug of choice for TIVA [(1)(2)].

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Sufentanil has been combined with propofol in total intra venous anaesthesia (TIVA) for various types of surgeries due to advent ages like synergistic action with propofol, rapid induction, less cardiovascular and respiratory depression, and rapid recovery profile better than fentanyl [3][4]. These properties can make, sufentanil an excellent adjuvant to propofol in TIVA for upper abdominal Laparoscopic surgeries where the intra-operative hemodynamic fluctuations due to pneumo -peritoneum and changes in patient position are better addressed, combination of sufentanil propofolTIVA provides better recovery of consciousness at emergence compared to inhalationalanaesthesia and good postoperative analgesia thus making it a useful combination for conducting upper abdominal laparoscopic surgery. However sufentanil efficacy as adjuvant to propofol in TIVA is not completely established. Hence attempt is made to evaluate the sufentanil combination with propofol at different concentration to justify the proper dosage and combination.

Material and Method

60 (sixty) patients admitted at GSL Medical College hospital Rajahmundry, Andhra Pradesh – 533296 were studied.

Inclusive Criteria: Adult patients (18 to 65 years) of ASA physical status I or II with Mallampati scores I and 2. Scheduled to undergo elective laparoscopic cholecystectomy were selected for study.

Exclusion Criteria: Body weight more than90 Kg, history of hypertension, IHD, history of Psychiatric disorder, patients with hepatic or renal dysfunction were excluded from study.

Selected patients had pre-anaesthetic check up were randomly classified into three groups of twenty each with the help of computer generated table of random numbers. The pharmacist of operation theatre was assigned for concentration of sufentanil to be added to the propofol infusion for each group. Solution pf propofol containing different concentrations of sufentanil or no sufentanil were prepared in 50 ml syringes by the operation theatre pharmacist as per the randomisationchart for each patient, immediately prior to induction. The intervention allocation was masked from the anaesthesiologist conducting study, the patients and the Nurses monitoring the patients in the post-anaesthetic care unit and subsequently in the ward.

Before start of anaesthetic intravenous access, was secured on each patient with 18 gauge intravenous catheter for fluid and drug administration. Pre-induction measurement of heart rate (HR) systolic Blood pressure (SBP), diastolic Blood pressure (DBD), Mean Arterial pressure, peripheral oxygen saturation, (SPO2) from anaesthesia monitor was taken as baseline measurement. Monitoring was continued throughout the period of anaesthesia and included electrocardiography, pulseoximetry non-invasive arterial pressure arterial pressure and capnography. Patients were pre-oxygenated for 3 minutes with 100% O2 by face mask. Anaesthesia was induced with slow IV injection of sufentanil 1 μg Kg and continuous infusion of propofol 100 μg Kg min^{-1}. Loss of response to verbal commands was taken as end point induction following which intermediate acting neuromuscular blocking agent; vecuronium 0.1 mg $Kg^{1}$was given. Trachea was Incubated after 3 minutes of mask ventilation and lungs were mechanically ventilated with O_2, Air mixture and end tidal CO_2 concentration ($E+CO_2$) 30-40 mm Hg, HR, SBP, DBO and SPO_2were recorded 1, 3, 5 minutes post-induction.

HR, SBP, DBP, SPO_2 and $EtCO_2$ were monitored throughout the intra-operative period and recorded every 15 minutes in the observation sheet. All patients received propofol infusion titrated to clinical situation in a range of 75 to 125 Kg mint, Hypotension defined as systolic blood pressure below 60 mm μg for more than 5 minutes, was treated by reducing propofol infusion by 10 μg $Kg^{1}min^{-1}$ but within the range of 75 to 125 μg, Kg^{1},min^{-1}. Additional intra venous fluids were given as deemed appropriate. Response was measured at 5 minutes intervals and the above measures continued until stabilisation of Blood pressure. Hypertension, defined as systolic Blood pressure above 95 mm/Hg for more than 5 minutes was treated by giving additional sufentanil (10μg) boluses. Sufentanil boluses 10 (μg)were also given to patients in all groups when there was increase in the heart rate by more than 20 beats per minutes or mean arterial pressure by more than 15% indicating lightering of anaesthesia. Response was reassessed at

5 minutes interval and the above measures repeated until stabilisation. Neuro muscular paralysis was prevented with timely top of doses of vecuronium. Ten minutes before the anticipated and of surgery (at the startof skin suturing) the infusion was stopped. Total volume of propofol given by infusion for each patient was recorded. Total amount of sufentanil and the number of additional boluses of sufentanil given for each patient was recorded.

Patients were shifted to the post-anaesthesia care unit where HR, SBP, DBP, RR and SPO2 were recorded every 15 minutes for 2 hours; All patients were given supplemental Oxygen with the face mask post-operating all patients received oral diclofenac 50 mg three times daily post-operative pain was assessed for 24 hours by 10-cm visual analogue scale (VAS) on which 0 mc represents no pain and 10cm represents worst imaginable pain [5].

Duration of study was June-2021 to July-2022

Statistical analysis: Various parameters of three groups undergoing laparoscopic cholecystectomy and administration of anaesthetic drugs, propofol, sufentanil, withor without sufentanil were compared with hemodynamic parameters; consumption of propofol, sufentanil, (recovery time) was with Anova test and chi-square were studied. The statistical analysis was carried out in SPSS software. The ratio of male and female was 2:1.

Observation and Results

S1 and S2 groups received propofol with sufentanil added at 1 µg m1 and 2 µg ml concentrations respectively while group P received propofol without sufentanil.

Table-1: Hemodynamic parameters HR (bpm), SBP (mm/Hg) and DBP (mm/Hg) at various time periods value for mean value ±SD and p value for comparison between groupsHR (Heart rate) of all time have significant differences

1. SBP (mm/Hg). DBP (mm/Hg) had significant differences in all three groups.
2. Post-Induction studies had HR, SBP, DBP HAD significant mean values (differences)
3. Intra-operative parameters like HR, SBP, DBP also had significant differences in all three parameter.
4. Post Intubation period had also HR, SDP, DP have significant mean values.
5. Post-operation conditions also all three hemodynamic parameters HR, SBP, DBP had significant mean values.

Table-2: Total consumption of propofol and sufentanil in all groups. In group-P (propofol) 63.5 (±4.60), in S1 (propofol with sufentanil) 56.48 (± 18.49), group S2 (without sufentanil0 54.78 (± 16.38), F=1.55 and p value in insignificant (p>0.22)

- Amount of sufentanil at induction (mcg) 73.24 (± 1.4) in group P, 70.20 (± 8.5) in group SI, 64.54 (± SD) in S2, F=5.83 and p<0.00 (p value is highly significant)
- Amount sufentanil given in infusion and propofol, (mcg) 56.5 (± 18.4) in S1 group, 112.4 (± 27.2) in S2 group, F=175.3 and p<0.0001 p value was significant
- Amount of sufentanil given as in group P, 10.81 (±6.02) in S1, 12.24 (± 5.32) and F=0.609 and p>0.5 and p value was Insignificant
- Number of patients who received intra-operative bolus 10 in group and group S1 and 6 in S2 and Chi square 2.17 and p<0.33 (p value Insignificant)
- Total amount of sufentanil consumed 80.72 (± 5.7) in group p, 135.2 (± 25.1) in group s1, 182.1 (± 36.2) F=70.3 and p<0.00 (highly significant)

Table-3: Distribution of number of patients who required additional intra-operative sufentanil boluses in three groups. Total No of patients were 28 (± 4.66%), 20(± 33.3%) in group-I, 6 (± 10%) in group-II, 1 (± 1.61%) in group-III

Table-4: Anaesthesia recovery time (Mean value ±SD) in post-operative period.

- Anaesthesia recovery period (time in minutes) 15 (± 4) in group-P, 15 (± 5) in group S1, 22 (± 8) in group S2, F test -9.33 and p<0.003 (highly significant)
- No of patients required rescue analgesic, 10 in group P, 6 in group S1 and 2 in group S2 and p<0.02 (p value was highly significant)

Table 1: Hemodynamic Parameters HR (6pm) SP (mm/Hg) and DBP (mm/Hg) at various time periods value are Mean values ±SD and P values for comparison between groups

Pre-Induction	Group P	Group S1	Group S2	PVS S1	PVS S2	S1V3S2
HR	85.15	84 ±10	79 ±11	0.80	0.10	0.17
SBP	132 ±11	130 ±16	132 ±14	0.66	1.00	.69
DBP	79 ±10	81 ±10	81 ±10	0.52	0.52	1.00
Post-Induction HR	72 ±1	67 ±2	66 ±2	0.42	0.13	1.00
SBP	102 ±3	98 ±3	99 ±2	0.96	1.00	1.00
DBP	58 ±2	57 ±3	55 ±3	1.00	1.00	1.00
Intra operative						
HR	69 ±2	72 ±2	70 ±2	0.85	1.00	1.00
SBP	112 ±2	112 ±2	111 ±2	1.00	1.00	1.00
DBP	70 ±3	69 ±3	65 ±2	1.00	0.38	0.58
Post Extubation						
HR	79 ±2	89 ±2	79 ±2	0.03	1.00	0.02
SBP	128 ±2	126 ±2	126 ±2	1.00	1.00	1.00
DBP	76 ±2	78 ±2	75 ±2	1.00	1.00	0.62
Post-operative						
HR	68 ±2	75 ±2	75 ±2	0.01	0.02	1.00
SBP	118 ±2	120 ±2	124 ±2	1.00	0.18	0.54
DP	75 ±2	74 ±2	75 ±2	1.00	1.00	1.00
SBP	118 ±2	120 ±2	124 ±2	1.00	0.18	0.54
DBP	75 ±2	74 ±2	75 ±2	1.00	1.00	1.00

Table 2: Total Consumption of propofol and sufentanil in all groups (Values mean ± SD)

Details volume of	Group-P (20)	Group-S1 (20)	Group-S2 (20)	ANOVA test	P value
Propofol consumed (ml)	63.5 (±14.66)	56.48 (±18.49)	54.78 (±16.38)	F=1.5539	P=0.2203
Amount of sufentanil at Induction (mcg)	73.24 (±1.4)	70.20 (±8.54)	64.54 (±11.20)	F=5.8387	P=0.0049**
Amount of sufentanil given in Infusion and propofol	0	56.5 (±18.40)	112.4 (±27.24)	F=175.3768	P=0.0001**
Amount of sufentanil given as intra-operative boluses	12.62 (±5.02)	10.81 (±6.02)	12.24 (±5.32)	F=0.6090	P=0.5474
No. of patients who received Intra operative boluses	10	10	6	Chi-square=2.1719	P=0.3375
Total amount of sufentanil consumed	80.72 (±15.77)	135.2 (±25.12)	182.13 (±36.28)	F=70.3773	P=0.0001**

**indicates highly significant

Statistically highly significant difference observed in Amount of sufentanil at Induction, Amount of sufentanil given in Infusion and propofol and Total amount of sufentanil consumed in Group P, Group S1 and Group S2 (P<0.01).

While no significant difference observed in propofol consumed, Amount of sufentanil given as intra-operative boluses and No. of patients who received Intra operative boluses in Group P, Group S1 and Group S2 (P>0.05).

Table 3: Distribution of the number of patients who required additional intra-operative sufentanil boluses in three groups

	0	1	2	3
Group P-No of patient	8	7	3	0
Frequency percentage	40%	35%	15%	0
Group S1-No of patient	8	9	0	1
Frequency percentage	40%	45%	0	5%
Group S2-No of patient	12	4	3	0
Frequency percentage	60%	20%	15%	0
Total – No of patients	28	20	6	1
Frequency percentage	46.6%	33.3%	10%	1.6%

Table 4: Comparison of Anaesthesia Recovery time (mean value ±SD) in post-operative period

Details	Group-P (20)	Group-S1 (20)	Group-S2 (20)	Test statistic P value
Anaesthesia recovery time (Minutes)	15 (±4)	15 (±5)	22 (±8)	F=9.3333 P=0.0003**
No. of patient required rescue Analgesic	10	6	2	Chi square=7.6190 P=0.0221*

*Indicates significant and **indicates highly significant

Statistically highly significant difference observed in anaesthesia recovery time among Group P, Group S1 and Group S2 patients (P<0.01). Also, there is significant difference observed in no. of patients required rescue Analgesic among Group P, Group S1 and Group S2 patients (P<0.05).

Discussion

Present comparative of TIVA with using propofol with or without sufentanil in Laparoscopic cholecystectomies in Andhra Pradesh Population. In comparison of in pre-induction, post-induction, in pre-operative, post-intubation, post-operative have insignificant p value (Table-1).

Distribution of boluses in number of patients who required additional intra-operative sufentanil boluses in three groups was compared. Total consumption additional in all (zero group) 28 (46.6%), 20 (33.3%) in 1st group, 6 (10%) in 2nd group, 1 (1.6%) in 3rd group (Table-3) Comparison of Anaesthesia recovery time in minutes 15 (± 4) in group P, 15 (± 5) in group S1, 22 (± 8) in group S2, F=9.33, p<0.003 (p value is highly significant) No. of patient required rescue analgesic 10 in group P, 6 in group S1, 2 in group S2, chi-square test -7.61 and p<002 (p value was highly significant) (Table-4). These finding are more or less in agreement in previous studies [6][7][8].

Propofol is a sedative hypnotic agent with excellent recovery characteristics at the end of infusion and additional anti-emetic property, has become drug of choice for TIVA. Hemodynamic parameters (heart rate, systolic and diastolic blood pressure)were not significant different in all three groups of patients in the pre-operative period. Fever group S2 had required additional sufentanil boluses

to maintain adequate depth of anaesthesia compared to other two groups, group S2 patients had better post-operative analgesia but had prolonged recovery time. Compared to other two groups sufentanil mixed with propofol provides better hemodynamic stability in present study with lesser requirement for additional sufentanil boluses and good post-operative analgesia.

It is reported that, increasing concentration of sufentanil reduce the volume of propofol consumed during surgery [(9)(10)].

It was also confirmed that, intra-operative usage sufentanil was very effective in providing excellent 24 hours post-operative analgesia [(11)] sufentanil is suitable for post-operative pain control because it has no active metabolites and shows a higher therapeutic Index and lower frequency of respiratory suppression hence it is ideal combination in upper abdominal surgeries in upper abdomen there are chances of impairment of hemodynamic parameters, pneumothoraxwhich may lead to morbidity and mortality.

Summary and Conclusion

In the present study it is noted that, both concentrations sufentanil achieve the goals of stable hemodynamic parameters without clinical recovery time. However 2µg mg concentration of sufentanil added to propofol provided greater peri-operative hemodynamic stability with lesser requirement of additional boluses and excellent post-operative analgesia but this study demands the clinical trials in larger group of patients to confirm the conclusion of present study of combinations of anaesthesia

Limitation of study – Owing to tertiary location of research centre, small number of patients and lack of latest techniques we have limited findings and research.

- The present research work was approved by Ethical committee of GSL Medical College Rajahmundry Andhra Pradesh-533296
- **No Conflict of Interest**
- **No Funding**

References

1. Manik JP, Breast flood R, Ward A – Sufentanil A review of its pharmacological properties and therapeutic use Drugs 1988, 36; 286-313.
2. Vuyk J, Mertens MJ, olofensen C – Propofol anaesthesia and rational opioid selection determination of optional EC_{50} – EC_{95} propofol opioid concentration that assure adequate anaesthesia and a rapid return of consciousness Anaesthesiology 1997, 87; 1549-1562.
3. Ahonen J, Olkola KT, Hynymen M – Comparison of al-fentanyl and sufentanil for total intravenous anaesthesia with propofol in patients undergoing coronary artery bypass surgery Br. J. Anaesth. 2000, 85; 533-540.
4. Kay B, Rolly G – ICI 35868 a new intravenous induction agent Acta Anaes Belgica 1977, 28; 303-10.
5. Benito MC, Gonzez zarco LM – Total intravenous anaesthesia in general surgery Rev. Esp. Anestosiol Reanin 1994, 41; 292-5.
6. Mi WD, Sakal T – Hemodynamic and electro cardiograph responses to intubation during induction with propofol or propofol / fentanyl / can J. Anaesth. 1998, 45; 19-22.
7. Vuyk J, Lim T, Edinverg FHM – The pharmaco-dynamic interaction of propofol and alfentanil during lower abdominal surgery in women Anaesthesiology 1955, 83; 8-22.
8. Lysakowski C, Dumant L – Effects of Fentanyl/ alfentanil, remifentanil and sufentanil on less of consciousness and bi-spectral index during propofol induction of anaesthesia Br. J. Anaesth. 2001, 86; 523-527.
9. Elisabeth Hentgen Malik Houfani – Propofol sufentanil Anaesthesia for thyroid surgery Anesth. Analg 2002, 95; 597-605.
10. Bell J, Sartain J – Propofol and fentanyl anaesthesia for patients with low cardiac output state undergoes cardiac surgery Br. J. Anaesth 1994, 73; 162-6.
11. Derrode N, Lebrun F, Levron JC – Influence of preoperative opioid on post-operative pain after major abdominal surgery sufentanil TCI versus remifentanil TCI Br. J. Anaesth. 2003, 91; 842-849.