

**Original article:**

## **Comparison of the Efficacy of Sufentanil versus Fentanyl as Adjuvant in Balanced Anaesthesia for Abdominal Surgeries**

**Dr. Sumit Kumar<sup>1</sup>, Dr. Amit Tyagi<sup>2</sup>, Dr. Prateek Singh Bais<sup>3</sup>, Dr. Deepak Malviya<sup>4</sup>,  
Dr. Manoj Tripathi<sup>1</sup>, Dr. Manoj Kumar Giri<sup>5</sup>**

1. Assistant Professor, Department of Anesthesia & Critical Care, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow

2. Consultant, Anesthesia & Critical Care, VPIMS, Lucknow

3. Assistant Professor, Department of Anesthesia & Critical Care, SGPGIMS, Lucknow

4. Professor & Head, Department of Anesthesia & Critical Care, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow

5. Associate Professor, , Department of Anesthesia & Critical Care, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow

Corresponding Author- Dr. Manoj Tripathi, Assistant Professor, Department of Anesthesia & Critical Care, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow

### **ABSTRACT**

**Background-** Opioids are very important adjuvants of balanced anesthesia. Fentanyl and sufentanil are known opioids. In this study we compared between the two for haemodynamic response, hyperglycemic response and side effects profile.

**Material & Methods-** The patients were randomly assigned into two groups of thirty patients each as Group I received intravenous analgesia using sufentanil 0.4mcg/kg during induction with supplemental doses of 0.1mcg/kg intraoperatively. Group II received intravenous analgesia using fentanyl 2mcg/kg during induction with supplemental doses of 0.5mcg/kg intraoperatively. Vitals are compared at different intervals.

**Results-** Intraoperatively increases in pulse rate at 30 min. in group II and at 60 min. in group I were statistically highly significant ( $P=0.000$ ). and increases in MAP at 60 min. in group I was statistically highly significant ( $P=0.002$ ). Rest of the postoperative period MAP in both groups were near to base line. VAS score was higher at 15, 30 and 45 minutes postoperatively in group II. The difference was highly statistically significant.

**Conclusion-** Sufentanil and fentanyl, when used as an analgesic component in balanced anaesthesia are similar in attenuating the hemodynamic and hormonal responses to surgical stimulation. Sufentanil, being more potent requires lesser doses (bolus as well as supplemental) than fentanyl.

**Keywords-** Fentanyl, Sufentanil, Visual Analogue Scale, Hemodynamic profile

### **INTRODUCTION**

Perioperative period is associated with various stimuli like laryngoscopy, intubation, skin incision, tissue handling, stretching of mesentery or gut. Body reacts strongly to these external stimuli. The magnitude of response is highly dependent on the severity, intensity and duration of stimulus. For triggering such reflex response the neuroendocrine hormone system and autonomic nervous system is brought in to action and is called "Stress Response"<sup>1,2</sup>.

Stress triggers hormonal-metabolic response, which results in increased levels of catecholamine, cortisol, free fatty acids and blood glucose concentration. Increased catecholamine levels results in tachycardia, hypertension and increased myocardial oxygen demand. The danger in patients suffering from hypertension or ischaemic heart disease is well known<sup>3</sup>. Opioids are very important adjuvants of balanced anaesthesia. The presence of opiate receptors in brain centers mediating the stress response<sup>4</sup> underlies the successful use of opioids in high doses to prevent or reduce the stress response to major surgery, including the prebypass phase of cardiac surgery. However, the comparative stress-modifying potential of opioids used in lower doses as component of balanced anaesthesia for non cardiac surgery has been investigated much less frequently<sup>5,6</sup>.

The purpose of this study was to compare:

- Effectiveness of fentanyl and sufentanil in attenuating the hemodynamic responses and hyperglycemic response to stress intraoperatively & postoperatively in abdominal surgeries.
- Postoperative analgesic duration and side effects like respiratory depression, sedation provided by sufentanil and fentanyl.

#### **MATERIAL AND METHODS**

The study evaluated sixty patients between fifteen to sixty five years, of either sex and ASA grade I, undergoing major abdominal surgery in a controlled, randomized double blind study. The type of operation, duration and blood loss were similar in both groups.

##### Exclusion criteria:

Hypertension, ischaemic heart disease, valvular heart disease,

Diabetes mellitus,

Respiratory diseases like asthma, COPD, pulmonary tuberculosis.

Drug allergy or narcotic abuse

Hematological derangements

Renal or hepatic derangement

Pregnant females

ASA grade II or more

Anticipated or encountered difficult intubation

Any patient requiring blood transfusion intraoperatively

Thorough pre-operative evaluation was done as per proforma. Investigations like haemogram, bleeding and clotting time, blood urea, serum creatinine, serum electrolytes, blood sugar level, urine for sugar and albumin were done. Other investigations were carried out whenever necessary. All the procedures for this study were in accordance with the standards of ethical committee in our institute and its approval was obtained.

Written informed consent was obtained in each case after explaining to the patients the surgical procedure, anaesthesia and the drugs to be used. The patients were randomly assigned into two groups of thirty patients each as -

- Sufentanil group (Group I): patients receiving intravenous analgesia using sufentanil 0.4mcg/kg during induction with supplemental doses of 0.1mcg/kg intraoperatively.

- Fentanyl group (Group II): patients receiving intravenous analgesia using fentanyl 2mcg/kg during induction with supplemental doses of 0.5mcg/kg intraoperatively.

All the patients underwent the same anaesthetic technique as below. Preoperatively, patients were kept fasting for at least 6 hours. Inj. glycopyrrolate 5mcg/kg was given intra-muscularly 30 min. prior to induction. All the necessary equipments and drugs including the emergency resuscitation were checked and kept ready.

Monitoring:

Monitoring included ECG, pulse-oximetry, non-invasive blood pressure, peripheral nerve stimulator, blood sugar level, blood loss and urine output.

Premedication:-

Baseline preoperative parameters like heart rate, blood pressure, respiratory rate & oxygen saturation were measured. Baseline visual analogue scale (VAS) and sedation score were assessed. A single observer made all the observations.

Intravenous access was established and ringer's lactate infusion was started. Following drugs were given as premedication intravenously- Inj. Ondansetron 0.1mg/kg and Inj. Midazolam 0.03 mg/kg.

Anaesthesia technique:-

All the patients were pre-oxygenated with 100% oxygen for 5 min. 3 min prior to induction pts were given a dose of either intravenous sufentanil 0.4 mcg/kg or fentanyl 2mcg/kg based on body weight in double blind fashion. Anaesthesia was induced in all the patients with Propofol 2-2.5 mg/kg intravenously. Succinylcholine 1.5 mg/kg intravenously was then given to facilitate endotracheal intubation. Patients were ventilated with 100% oxygen and upon full relaxation laryngoscopy and endotracheal intubation with proper sized endotracheal tube was carried out under vision using Macintosh laryngoscope blade by the same person each time.

All intubations which were smooth gentle and within thirty seconds were selected. After intubation, anaesthesia was maintained with 50% nitrous oxide in oxygen and 1% sevoflurane with intravenous vecuronium 0.08 mg/kg to maintain muscle relaxation on controlled ventilation. The degree of neuromuscular blockade was estimated with a peripheral nerve stimulator according to the train of four principle using 2 hertz supramaximal stimulation of ulnar nerve.

Sevoflurane was delivered at fix flow rate of 1% dial concentration to all the patients. Additional supplemental doses of either intravenous sufentanil 0.1 mcg/kg or fentanyl 0.5 mcg/kg were administered when signs of insufficient depth of anesthesia developed- notably: increase in systolic blood pressure by more than 15% of base line value; tachycardia if not caused by deficiency of volume or blood loss or inadequate relaxation; tears, sweating. Opioid supplements were not given within 20 min of the estimated completion of the surgery. Sevoflurane was discontinued at the termination of surgery. After completion of dressing nitrous oxide was discontinued and substituted with 100% oxygen. Residual neuromuscular blockade was reversed with intravenous neostigmine 0.05mcg/kg and intravenous glycopyrrolate 10 mcg/kg and confirmed with train of four stimulation. Patients were extubated once adequate recovery of motor power (able to sustain head lift and strong hand grasp) and airway reflexes were assured. Patients

were kept in recovery room postoperatively for two hours and monitored closely. None of the patient had any recall of any intraoperative events.

Data Collection:

The pulse rate, systolic and diastolic blood pressure were recorded at the following intervals -

- Baseline, before administration of pre anesthetic medication
- one minute after laryngoscopy and intubation
- One min. after skin incision
- Intra operatively every thirty minute till the termination of surgery (defined as end of skin suture) and postoperatively after extubation at 15min., 30, 45, 60, 90 min. and 120 min.
- Postoperatively, respiratory rate, visual analogue score, sedation score and oxygen saturation were measured after extubation at 15min, 30, 45, 60, 90 and 120 minute.
- Blood sugar level was measured at base line, 60 min. after skin incision and 120 min. postoperatively.

ECG monitoring was done to note any cardiac irregularities, and continued through out the procedure.

Visual analogue scale<sup>7,8</sup> consisted of a ten centimeters scale representing varying intensity of pain from zero (no pain) to ten (worst imaginable pain) Sedation was evaluated using a four point ordinal scale<sup>9</sup>

Level of sedation	Feature
0	Wide awake
1	Drowsy
2	Sleepy but arousable
3	Non-arousable with loss of verbal contact

Respiratory depression considered when respiratory rate was less than ten.

Pulse oximetry reading less than 92 % on room air.

Rescue analgesia was given as inj. Diclofenac sodium 75 mg intra muscular when VAS score was equal to or more than five.

All patients received Ringer's lactate solution through out the procedure.

None of the patient received dextrose containing solution (except when blood sugar level was less than 80 mg %). None of the patients received blood transfusion at any point of time.

**DATA ANALYSIS:**

Data was analyzed using Students t test for paired (same group), Unpaired t test (between groups), Chi square test and Mann Whitney test. A P-value < 0.05 was considered statistically significant.

**OBSERVATIONS AND RESULTS**

Both the groups are comparable with respect to age and weight as shown in the table above. The analysis was done by t-test, (P>0.05).  $\chi^2 = 0.278$ , P>0.598 (Chi-square test) Sex distribution was also comparable in both groups. Type of surgeries, mean duration of surgeries and blood loss is comparable in both groups.

By applying unpaired t test, preoperatively pulse rate, MAP and respiratory rate were comparable in both groups. In group I & II, there was small rise in the pulse rate & MAP at one min. after laryngoscopy and intubation, but this difference was statistically not significant as compared with baseline value by paired t test.( P> .05 ) By comparing the Group I and II using unpaired t test, we found no significant difference between groups after 1 minute of intubation in terms of Heart rate and Mean arterial pressure.( P> .05 )

Table 1- Comparison of mean pulse rate at different intervals intra operatively between group I and group II

Parameters	Gr. I Mean± S.D. (n=30)	Gr. II Mean± S.D. (n=30)	P value
Base line	82.13 ± 6.42	83.63 ± 8.19	0.433
1 min. after skin incision	80.90 ± 6.31	82.43 ± 8.48	0.430
30 min.	80.70 ± 6.36	82.70 ± 7.65	0.276
60 min.	80.33 ± 5.13	80.30 ± 6.97	0.983
90 min.	79.37 ± 5.55	79.60 ± 6.77	0.884
120 min.	78.17 ± 5.49	76.87 ± 7.71	0.455
End of surgery	77.10 ± 5.14	76.63 ± 7.75	0.784

On comparison of group I and II, the changes in mean pulse rate values at different intervals intraoperatively were statistically not significant.

Table 2- Comparison of mean arterial pressure at different intervals intraoperatively between group I and group II

Parameters	Gr. I Mean± S.D. (n=30)	Gr. II Mean± S.D. (n=30)	P value
Base line	92.99 ± 3.93	94.06 ± 5.90	0.409
1 min. after skin incision	92.48 ± 3.95	93.66 ± 5.84	0.364
30 min.	91.42 ± 3.32	93.40 ± 4.14	0.056
60 min.	91.30 ± 3.39	92.14 ± 3.79	0.380
90 min.	91.07 ± 3.64	91.43 ± 4.38	0.726
120 min.	90.03 ± 3.64	90.36 ± 3.86	0.733
End of surgery	89.14 ± 3.36	88.89 ± 4.20	0.796

On comparison of group I and II, the changes in MAP values at different intervals intraoperatively were statistically not significant.

Table 3- Comparison of mean pulse rate at different intervals post operatively between group I and group II

Parameters	Gr. I Mean ± S.D. (n=30)	Gr. II Mean ± S.D. (n=30)	P value
Base line	82.13 ± 6.42	83.63 ± 8.19	0.433
15 min.	79.80 ± 6.72	80.27 ± 10.0	0.833

30 min.	80.90 ± 6.22	89.33 ± 8.80	0.000*
45 min.	86.60 ± 7.25	87.33 ± 7.37	0.699
60 min.	91.70 ± 6.34	79.60 ± 8.37	0.000*
90 min.	80.70 ± 6.36	82.70 ± 7.65	0.276
120 min.	80.33 ± 5.13	80.30 ± 6.97	0.983

\*: Highly significant

On comparison, increases in pulse rate at 30 min. in group II and at 60 min. in group I were statistically highly significant (P= 0.000).

Rest of the postoperative period mean pulse rate in both groups were near to base line.

Table 4- : Comparison of mean arterial pressure ( MAP) at different intervals post operatively

\*: Highly significant

Parameters	Gr. I Mean± S.D. (n=30)	Gr. II Mean± S.D. (n=30)	P value
Base line	92.99 ± 3.93	94.07 ± 5.90	0.409
15 min.	92.77 ± 5.71	92.65 ± 5.26	0.932
30 min.	93.50 ± 4.40	94.21 ± 5.01	0.562
45 min.	91.30 ± 3.39	92.14 ± 3.97	0.380
60 min.	96.97 ± 5.20	92.50 ± 5.24	0.002*
90 min.	93.04 ± 4.23	91.58 ± 5.05	0.228
120 min.	91.42 ± 3.32	93.40 ± 4.13	0.056

On comparison, increases in MAP at 60 min. in group I was statistically highly significant (P= 0.002).

Rest of the postoperative period MAP in both groups were near to base line.

**Paired t test** was applied for comparison within individual groupsto assess blood sugar level.

In group I: There was rise in the BSL at one hour after skin incision and postoperatively at 2 hour. This difference was statistically highly significant as compared with baseline value (P = 0.000) and (P=0.000) respectively.

In group II: There was rise in the BSL at one hour after skin incision and postoperatively at 2 hour. This difference was statistically highly significant as compared with baseline value (P = 0.000) and (P=0.000) respectively.

**Unpaired t test was applied for comparison between two groups.** There was no significant difference in baseline BSL of group I and group II (P= 0.702)

There was rise in BSL at I hour after skin incision and postoperatively at 2 hour in both groups. This rise was statistically not significant (P=0.680) and (P=0.107) respectively.

**Table 5: Comparison of Visual analogue score (VAS) in both groups at different intervals post operatively**

Parameters	Gr. I VAS score (Median) (n=30)	Gr. II VAS Score (Median) (n=30)	P value
15 min.	2.00	3.00	0.000*
30 min.	3.00	5.00	0.000*
45 min.	4.00	5.50	0.005*
60 min.	6.00	6.00	0.407
90 min.	6.50		

\*: Highly significant

Comparison was done by using Mann-Whitney test. VAS score was higher at 15, 30 and 45 minutes postoperatively in group II. The difference was highly statistically significant.



By applying unpaired t test, on comparison, mean duration required to give rescue analgesia is much higher in group I than in group II. This difference was statistically highly significant (P= 0.000).

Table 6- Comparison of sedation level in both groups at different intervals post operatively

Parameters	Gr. I Sedation Score (Median) (n=30)	Gr. II Sedation Score (Median) (n=30)	P value
15 min.	2.00	2.00	0.235
30 min.	1.00	0.00	0.056
45 min.	0.00	1.00	0.119
60 min.	0.00	0.00	0.522
90 min.	0.00	0.00	0.078
120 min.	0.00	0.00	

Comparison was done by using Mann-Whitney test.

Sedation score was comparable in both groups throughout postoperative period. This difference was statistically not significant (P > 0.05).

By applying unpaired t test, on comparison of group I and II, number of opioid supplementations per patient was statistically highly significant (P = 0.003).

None of the patients had respiratory depression post - operatively.

## DISCUSSION

An ideal perioperative analgesic should offer protection against the pressor response, should provide intense analgesia, sufficient to relieve pain of surgical incision, maintain the hemodynamic parameters and should provide adequate postoperative analgesia and should be devoid of side effects of morphine like nausea, vomiting, pruritus, sedation and respiratory depression. This has led to the development of a series of opioids i.e. fentanyl, sufentanil, alfentanil, remifentanil etc. Sufentanil, a N-4 thienyl derivative of fentanyl, is 5-10 times more potent than fentanyl.

#### HEMODYNAMIC RESPONSES TO LARYNGOSCOPIC AND INTUBATION SUFENTANIL GROUP (GROUP I)

In sufentanil group mean baseline pulse rate was  $82.13 \pm 6.42$  beats/min. One min after laryngoscopy and intubation mean pulse rate was  $83.97 \pm 5.94$  beats/min. Increase in mean pulse rate after intubation, as compared to baseline was statistically not significant ( $P=0.081$ ).

There was change in mean arterial pressure (MAP), from base line  $92.99 \pm 3.93$  mmHg to  $93.23 \pm 3.88$  mmHg one min after intubation. This rise in MAP was statistically not significant ( $P=0.104$ ).

ECG changes were not seen in any of the patient in both groups.

Davy C.H.Cheng et al in 1990<sup>10</sup>, studied the effect of sufentanil(1.0mcg/kg) versus low dose sufentanil(0.5 mcg/kg) on the cardiovascular responses to tracheal intubation. They concluded that even low dose sufentanil (0.5 mcg/kg) was equally effective in attenuating the pressor responses to intubation.

Kay B, Nolan D, Mayall R, Healy TE<sup>11</sup>(1987) studied the effects of sufentanil 0.5mcg/kg and 1 mcg/kg, given intravenously after induction of anaesthesia on the cardiovascular responses to tracheal intubation. They concluded that sufentanil 0.5 mcg/kg attenuated increase in mean values of heart rate and arterial pressure effectively.

Casati A, Fanelli G et al (2001)<sup>12</sup>, compared low dose sufentanil (0.1mcg/kg followed by infusion of 0.01mcg/kg/min) and remifentanyl (1.0mcg/kg followed by infusion of 0.1mcg/kg) after midazolam premedication. They found that low dose sufentanil (<0.5 mcg/kg) was as effective as remifentanyl in blunting the pressor response.

The result of our study was comparable to above studies.

We conclude that sufentanil in a dose of 0.4 mcg/kg attenuates the pressure response to laryngoscopy and intubation effectively.

#### FENTANYL GROUP (group II)

In fentanyl group, mean baseline pulse rate was  $83.63 \pm 8.19$  beats/min. One min after intubation mean pulse was  $83.77 \pm 8.046$ . This rise was statistically not significant ( $P=0.580$ ).

Baseline MAP was  $94.06 \pm 5.90$  mmHg. One min after intubation rise in MAP was  $94.08 \pm 5.73$  mmHg. This rise was statistically not significant ( $P=0.941$ ).

Kautto U. M. (1982) <sup>13</sup>studied the effect of two doses of fentanyl (2mcg/kg & 6mcg/kg) in attenuating the stress response to laryngoscopy & intubation. He found that 2mcg/kg also significantly attenuates the rise in heart rate & blood pressure.

Chung F. and Evans D. in 1985<sup>14</sup> studied hemodynamic responses to laryngoscopy & intubation with low dose fentanyl (3 mcg/kg) and found that low dose fentanyl attenuates pressor response to intubation.

The result of our study was comparable to above studies.

Prakanrattana U, Suksompong S.<sup>15</sup>(2002) compared sufentanil (0.5mcg/kg) and fentanyl (1mcg/kg) for surgical repair of congenital cardiac defects. They found that, following tracheal intubation, all hemodynamic parameters in sufentanil group remained below the baseline values, while the fentanyl group showed an increase above baseline values.

In above study there was no attenuation of pressor response to intubation in fentanyl group, probably due to lower dose( 1 mcg/kg) used in the study. Here, we conclude that fentanyl in a dose 2 mcg/kg attenuates the pressure response to laryngoscopy and intubation effectively.

When sufentanil group and fentanyl group were compared, the difference in the mean values of pulse rate and MAP was not significant statistically. (P= 0.072 and P=0.290respectively).

M. M. Ghoneim et al(1984)<sup>16</sup>compared fentanyl & sufentanil along with morphine and meperidine, as supplements to nitrous oxide anesthesia. They found that fentanyl & sufentanil were equally satisfactory in preventing the hemodynamic response during laryngoscopy and intubation effectively.

Kietzmann D.et al in 1996<sup>17</sup>compared sufentanil-propofol with fentanylpropofol in major abdominal surgery. They concluded that with both regimen stress response to intubation was nearly completely suppressed.

The result of our study was comparable to above studies.

So we observed that sufentanil in a dose of 0.4 mcg/kg and fentanyl in a dose of 2mcg/kg are equally effective in attenuating the hemodynamic responses to laryngoscopy and intubation.

Total attenuation would probably be possible if larger doses would have Used<sup>18</sup>.

#### HEMODYNAMIC CHANGES INTRA AND POSTOPERATIVELY

Opioids are known to be cardiostable agents providing hemodynamic stability intraoperatively. This is because of intense analgesia, suppression of sympathoadrenal response and lack of significant cardiovascular depressant effects. When we compared the hemodynamic parameters i.e., pulse rate and blood pressure throughout the intraoperative period at different intervals, we observed that both the drugs provided stable hemodynamic conditions without undue swings in pulse and blood pressure.

There was no statistically significant difference in hemodynamic parameters intraoperatively.

Postoperatively after 30 min there was statistically significant difference in pulse rate between the two groups and after 60 min, statistically significant difference in pulse rate as well as blood pressure.

This observed difference could be because of difference in duration of analgesia provided by sufentanil and fentanyl, which will be discussed subsequently.

ECG changes were not seen in any of the patient in both groups intra and postoperatively.

M. M. Ghoneim et al(1984)<sup>19</sup> found that fentanyl & sufentanil were equally satisfactory in preventing the hemodynamic stress response during surgery.

D.Kietzmann et al (1991)<sup>20</sup> found that sufentanil was similar to fentanyl in attenuating the hemodynamic & hormonal responses to surgical stimulation.

Crozier T. A. et al (1994)<sup>21</sup> compared hemodynamic & endocrine stress response during total intravenous anesthesia with sufentanil midazolam & fentanyl midazolam in patients undergoing elective major abdominal surgery. They concluded that hemodynamic responses were stable in both groups intraoperatively.

The result of our study correlates well with all above studies.

#### INTRAOPERATIVE SUPPLEMENTAL DOSES OF SUFENTANIL AND FENTANYL

To maintain the stable hemodynamic parameters intraoperatively the mean number of supplemental doses of sufentanil was 2.2 per patient and that of fentanyl was 2.7 per patient. This difference was statistically significant ( P=0.003). This proves that duration of analgesic action of sufentanil is more than fentanyl.

J. Flake in et al in 1985<sup>22</sup>found that more number of fentanyl supplements (4.1 per patient) required than sufentanil (3.2 per patient) to maintain the stable hemodynamic parameters intraoperatively.

The result of our study correlates well with above study.

#### PERIOPERATIVE CHANGES IN BLOOD SUGAR LEVEL:

Surgical trauma triggers a hormonal-metabolic response, which results in increased levels of catecholamine, cortisol, free fatty acids and blood glucose concentration during perioperative period. In our study we measured blood glucose concentration as a marker of metabolic response to stress

There was rise in BSL at 1 hour after skin incision and postoperatively at 2 hour in both groups. This rise was statistically not significant ( $P=0.680$ ) and ( $P=0.107$ ) respectively.

So we observed that sufentanil in a dose of 0.4 mcg/kg and fentanyl in a dose of 2mcg/kg, during intraoperative period, attenuate hyperglycemic response to surgical stress but, does not abolish it completely. However, two hours postoperatively, there was no attenuation of hyperglycemic response as the rise in BSL was significant. This could be because of shorter half life of both opioids.

K. Giesecke et al (1988)<sup>23</sup> compared the influence of high dose fentanyl (100 mcg/kg) & low dose fentanyl (5mcg/kg plus infusion of 3 mcg/kg/hour) anesthesia on hormonal & metabolic responses during cholecystectomy between two groups. They showed that intraoperatively in both groups increase in blood glucose concentration was abolished. In postoperative period, however significant increase in blood glucose concentration in low dose fentanyl group was noted.

In above study there was complete suppression of hyperglycemic response intraoperatively and in our study there was relatively less suppression. This difference in the degree of response could be because of difference in doses of fentanyl.

Thomas Schricker et al (2000)<sup>24</sup> studied the influence of propofol sufentanil (0.5 mcg/kg) anesthesia on metabolic & endocrine responses intra & postoperatively in lower abdominal surgeries. They found that propofol sufentanil anesthesia attenuated (but not prevented totally) hyperglycemic response during the surgery. Postoperatively after two hours significant rise in BSL was noted.

Higher doses may achieve complete attenuation of hyperglycemic response intraoperatively, and for longer duration in postoperative period.

#### POSTOPERATIVE ANALGESIC DURATION

The subjective method of assessment of pain by far is the best method which we have used in our study. The visual analog scale (VAS) was assessed at the interval of 15 minutes in the postoperative period.

Rescue analgesia was given in the form of diclofenac sodium 75 mg intramuscularly when the VAS score reached  $\geq 5$ .

When VAS in both groups was compared at 15 min, 30 min and 45 minute postoperatively, median VAS score was higher in fentanyl group. This difference was statistically highly significant. ( $P= 0.000$  at 15 min,  $P=0.000$  at 30 min and  $P=0.005$  at 45 min respectively )

So, by above observation it is noted that 30 min postoperatively 22 out of 30 patients in fentanyl group experienced enough pain to receive rescue analgesia, while only 4 patients in sufentanil group requested for analgesia by that time.

Thus we observed that sufentanil provides longer duration of postoperative analgesia as compared to fentanyl.

Tauzin-Fin P. et al (1995)<sup>25</sup> compared sufentanil with fentanyl as a supplement to balanced anesthesia in 30 elderly patients undergoing major urological surgery. They concluded that sufentanil provides longer analgesic duration than fentanyl in immediate postoperative period.

Phitayakorn P. et al (1987)<sup>26</sup> compared sufentanil with fentanyl as an adjuvant to general anesthesia in 50 patients undergoing outpatient D&C. they concluded that postoperative analgesic duration was more with sufentanil compared to fentanyl.

Manjula Sarkar et al(2007)<sup>27</sup> concluded that duration of analgesia provided by sufentanil was slightly longer than fentanyl.

The result of our study correlates well with above studies.

#### SIDE EFFECTS:

##### 1. Sedation:

We assessed the sedation level in postoperative period at the interval of every 15 minutes using four points ordinal scale and observed that median sedation score was comparable in both the groups throughout postoperative period and this difference was statistically not significant. None of the patient in both groups was heavily sedated (i.e. sedation score 3) during entire postoperative period.

C.Motamed et al(2006)<sup>28</sup> found in his study that no patient had heavy sedation in either of group in postoperative period.

Our study is comparable with above study.

So we conclude that fentanyl in a dose of 2 mcg/kg and sufentanil in a dose of 0.4 mcg/kg do not cause respiratory depression.

#### Conclusion

our findings suggest that, sufentanil and fentanyl, when used as an analgesic component in balanced anaesthesia are similar in attenuating the hemodynamic and hormonal responses to surgical stimulation. Sufentanil, being more potent requires lesser doses (bolus as well as supplemental) than fentanyl. Additionally, sufentanil provides longer duration of analgesia in immediate postoperative period without any respiratory depression. However it is nearly 2.5 times more expensive than fentanyl. So to evaluate cost effectiveness of sufentanil over fentanyl further studies are required.

#### References

1. Guyton AC and Hall. The adrenocortical hormones: Text book of medical physiology 9th edition WB Saunders company 1998; 77:957-970.
2. Lin E, Lowry SF, Calvano SE. the systemic response to injury. Principles of surgery, international edition Vol-1, McGrawHill Health Profession Division. 7th ed, 3-35.
3. Prys Roberts, Grene LT, Meloche R and Foex R. Hemodynamic consequences of induction and endotracheal intubation. British journal of Anaesthesia 1971; 43:531-547.
4. Yaksh TL. Multiple opioid receptor systems in brain and spinal cord. Eur J Anaesth 1984; 1: 171-199, 201-243.
5. Flacke JW, Bloor BC, Kripke BJ, Flacke WE. Comparison of morphine, meperidine, fentanyl and sufentanil in balanced anaesthesia: A double blind study. Anesth Analg 1985; 64: 897-910.
6. Ghoneim MM, Dhanraj J, Choi WW. Comparison of four opioid analgesics as supplements to nitrous oxide anaesthesia. Anesth Analg 1984; 63:405 -412.
7. Clark NJ, Meuleman T, Wen-Shin, Pace NL. Comparison of sufentanil -N<sub>2</sub>O and fentanyl- N<sub>2</sub>O in patients without cardiac disease undergoing general surgery. Anaesthesiology 1987; 66: 130-135.

8. Schricker T, Carli F, Schreiber M, Wachter U, Geisser W, Lattermann R. Propofol/Sufentanil anesthesia suppresses the metabolic and endocrine response during, not after, lower abdominal surgery. *AnesthAnalg*2000;90:450 -455
9. Campbell DC, Camann WR, Datta S. The addition of bupivacaine to intrathecal sufentanil for labor analgesia. *AnesthAnalg* 1995Aug; 81(2): 305-9.
10. Cheng DC, Chung F, Chapman KR, Romanelli J. low dose sufentanil and lidocaine supplementation of general anaesthesia. *Canadian journal of anaesthesia*.1990 Jul;37(5);521-7
11. Kay B, Nolan D,Mayall R, Healy TE. The effect of sufentanil on the cardiovascular responses to tracheal intubation. *Anaesthesia* 1987Apr; 42(4):382-6.
12. Casati A, Fanelli G. Small doses of remifentanil or sufentanil for blunting cardiovascular changes induced by tracheal intubation: a double -blind comparison. *European Journal of Anaesthesiology*.2001Feb; 18(2); 108-12.
13. Kautto UM. Attenuation of the circulatory response to laryngoscopy and intubation by fentanyl. *Acta Anaesthesiol Scand*. 1982; 26: 217221.
14. Chung F and Evans D. Low dose fentanyl: hemodynamic response during induction and intubation in geriatric patients. *Can Anaesth Soc. Journal* 1985; 32: 622-628.
15. Prakanrattana U, Suksompong S. Comparison of sufentanil and fentanil for surgical repair of congenital cardiac defects. *Journal of Medical Association Thai* .2002 Sept;85 Suppl3;S807-14
16. Ghoneim MM, Dhanraj J, Choi WW. Comparison of four opioid analgesics as supplements to nitrous oxide anesthesia. *Anesth Analg*1984;63:405 -412.
17. Kietzmann D, Hahne D, Crozier TA, Weyland W, Gröger P, Sonntag H. Comparison of sufentanil-propofol-anesthesia with fentanylpropofol in major abdominal surgery. *Anaesthesist*. 1996 Dec;45(12):1151-7.
18. Shupak RC, Harp JR. Comparison between high dose sufentaniloxygen and high dose fentanyl-oxygen for neuroanaesthesia. *Br J Anaesth*. 1985; 57:375-381.
19. Ghoneim MM, Dhanraj J, Choi WW. Comparison of four opioid analgesics as supplements to nitrous oxide anesthesia. *Anesth Analg*1984;63:405 -412.
20. Kietzmann D, Larsen R, Rathgeber J, Bolte M, Kettler D. Comparison of sufentanil-nitrous oxide anaesthesia with fentanylnitrous oxide anaesthesia in geriatric patients.*Br J Anaesth*. 1991 Sep; 67(3):269-76.
21. Crozier TA, Langenbeck M, Muller J, Kietzmann D, Sydow M, Kettler D. Total intravenous anaesthesia with sufentanil-midazolam for major abdominal surgery. *Eur J Anaesthesiol*. 1994 Nov; 11(6):449-59.
22. Flacke JW, Bloor BC, Kripke BJ, Flacke WE. Comparison of morphine, meperidine, fentanyl and sufentanil in balanced anaesthesia: A double blind study. *Anesth Analg*1985; 64: 897-910.
23. Giesecke K, Hamberger B, Jarnberg PO, Klingstedt C. High and low dose fentanyl anaesthesia: Hormonal and metabolic responses during cholecystectomy. *Br J Anaesth*. 1988 ; 61:575-582.
24. Schricker T, Carli F, Schreiber M, Wachter U, Geisser W, Lattermann R. Propofol/Sufentanil anesthesia suppresses the metabolic and endocrine response during, not after, lower abdominal surgery. *AnesthAnalg*2000;90:450 -455

25. Tauzin-Fin P, Krol-Houdek MC, Muscagorry JM, Assoune P. Comparative study of sufentanil and fentanyl in urologic surgery in adults. *CahAnesthesiol.* 1995; 43 (1): 55-60.
26. Phitayakorn P, Melnick BM, Vicinie AF 3rd. Comparison of continuous sufentanil and fentanyl for outpatient anaesthesia. *Can J Anaesth.* 1987 May; 34 (3(pt 1) ): 242-245.
27. Sarkar M, Mahajan P, Dewoolkar L. Comparative study of
28. intravenous infusion of sufentanil vs. fentanyl for post operative analgesia in anaesthesia intensive care unit. *J. Anaesth. Clin pharmacology.* 2007; 23(3): 249-253.
29. Motamed C, Merle JC, Yakhou L, Combes X. Postoperative pain scores and analgesic requirements after thyroid surgery: Comparison of three intraoperative opioids regimens. *Int J Med Sci.* 2006; 3(1): 11 -13.