

COMPARATIVE EVALUATION OF INTRATHECAL, EPIDURAL AND INTRAVENOUS BOLUS SUFENTANIL FOR POST OPERATIVE ANALGESIA IN LOWER LIMB SURGERYSudhakar Dwivedi¹, Subhash Kumar Agarwal²**HOW TO CITE THIS ARTICLE:**

Sudhakar Dwivedi, Subhash Kumar Agarwal. "Comparative Evaluation of Intrathecal, Epidural and Intravenous Bolus Sufentanil for Post-Operative Analgesia in Lower Limb Surgery". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 48, June 15; Page: 8288-8293, DOI: 10.14260/jemds/2015/1203

ABSTRACT: In clinical experience sufentanil is more effective when given epidurally than intrathecally and intravenously. To test this hypothesis we compare the analgesic characteristic of 10µgm of epidural, intrathecal and intravenous single shot sufentanil for pain relieve after elective lower limb surgeries. A randomized double blind trial was conducted on 60 patients who were under- going elective lower limb surgery in epidural anesthesia with bupivacaine. In recovery room as soon as pain score higher than 3 on the scale of 10 on visual analogue score was reported 10µgm intravenous, intrathecal and epidural was given respectively. We concluded that epidural sufentanil is better as compared to intrathecal and intravenous in terms of duration of pain relief, vital complications and side effects for post-operative pain relief.

KEYWORDS: Sufentanil, Epidural, Intrathecal, Intravenous opioids, post-operative pain relief.

INTRODUCTION: Postoperative pain has received little attention in ever expanding spectrum of anaesthesiology. Too often the responsibility of relieving pain is considered over once the patient is in recovery room. Sufentanil is twice as lipid soluble as fentanyl and is highly bound (93%) to plasma proteins including alpha 1-acid glycoprotein. The major metabolic pathways of sufentanil include N-dealkylation, oxidative O-demethylation, and aromatic hydroxylation. The PKA of sufentanil at physiologic pH is the same as that of morphine (8.0) and therefore, only a small amount (20%) exists in the Un-ionized form. Drugs that are more lipids soluble and less ionized at body pH tend to enter the central nervous system more rapidly. Sufentanil satisfies both of these requirements. Sufentanil is 5-10 time more potent than Fentanyl. It causes less cardiovascular depression and less respiratory depression than morphine & Fentanyl.

Many studies were conducted to assess the role of sufentanil in postoperative analgesia but there was no study comparing different route of administration of sufentanil for postoperative analgesia. Fouriers et al (2005)¹ showed that after total hip replacement intrathecal route of sufentanil rapidly offers excellent analgesia of better quality and longer duration when compared with intravenous route.

MATERIALS AND METHODS: This study was conducted in 60 patients admitted in the hospital for lower limb surgeries under spinal anaesthesia. Emergency surgeries, contraindication of epidural and spinal insertion, patients on ventilatory support, allergy to medication, patients with respiratory depression, and patients with liver diseases were excluded from study. All patients were selected at random and were divided into three groups of 20 each.

Group I: Single dose sufentanil injected intravenously.

Group II: Single dose sufentanil injected intrathecally.

Group III: Single dose sufentanil injected epidurally.

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History of patient was taken and pre-anaesthetic checkup was done. All the patients were pre-medicated with Alprazolam 0.25mg HS and Ranitidine 150mg HS. With all aseptic precautions epidural catheter was inserted and the case was conducted in epidural anaesthesia with bupivacaine using Touhy's needle. In the recovery room as soon as pain scores higher than 3 in scale of 10 in visual analogue score intravenous, intrathecal and epidural 10µgm sufentanil will be given to group I, II and III respectively. If pain scored higher than 3 after 15 minutes of drugs administration rescues analgesic in form of 25µgm fentanyl IV shots were given as per required. Pulse, Blood pressure, Respiratory rates, SPO₂ were noted and charted. Pain will be assessed on visual analogue score at rest and visual analogue score on movement on scale of 0-10 where 0 stands for no pain and 10 stands for worst imaginable pain at arrival in post anaesthesia care unit assessed at 0, 2, 6 hour.

Patient Satisfaction Score as Excellent, good, satisfactory and poor:

1. Sleep pattern on 3 point scale. (a) Slept well, (b) Interrupted sleep, (c) Could not sleep.
2. Rescue analgesic requirement.
3. Side effects–incidence of post-operative nausea, vomiting, pruritus and respiratory depression.

The study data were analyzed by comparing different groups by using paired t test. Statistical significance was considered if p value was less than 0.05.

RESULTS AND OBSERVATIONS:

VAS at various times	0 hr.	2 hr.	6 hr.
I	0.40±0.59	1.60±0.99	5.35±0.93
II	0.40±0.59	0.75±0.63	3.90±0.85
III	0.70±0.57	0.90±0.64	1.84±0.74

Table 1: Post-Operative Vas

Rescue Analgesic Required	Group I	Group II	Group III
0 hrs	8(40%)	0(0%)	4(20%)
2 hrs	12(60%)	2(10%)	10(50%)
6 hrs	0(0%)	18(90%)	6(30%)

Table 2: Rescue Analgesic Requirement

Side Effects	Group-I	Group-II	Group-III
Nil	2(10%)	12(60%)	18(90%)
Sedation	12(60%)	2(10%)	0
Dryness of mouth	2(10%)	1(5%)	0
Nausea Vomiting	4(20%)	1(5%)	1(5%)
Pruritus	0	4(20%)	1(5%)

Table 3: Side effects

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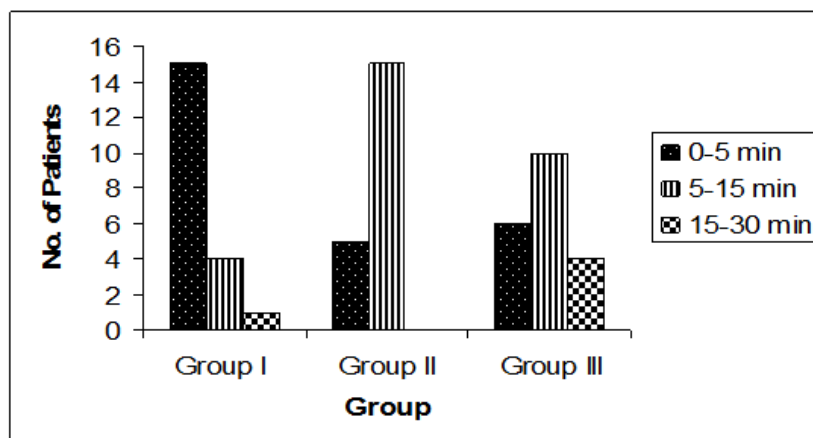


Fig. 1: Onset of Analgesia

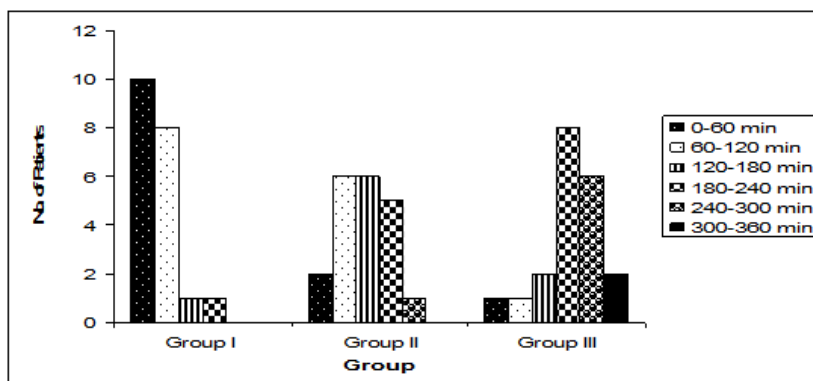


Fig. 2: Duration of Analgesia

DISCUSSION: Epidural analgesia for post-operative pain relief was first advocated by Cleland (1994).² Use of epidural narcotics for relief of post-operative pain is today a subject of extensive studies. This method, probably will find more use because of low incidence of side effects and absence of sympathetic blockade and motor blockade (With opioid use).

Dyer RA, Camden-Smith K et al³ concluded that sufentanil 10µgm intrathecal provides rapid and effective analgesia of 1-2 hr duration during labor. Intravenous use of this dose of sufentanil did not provide evidence of satisfactory analgesia. Mason N et al (2002)⁴ concluded that combination of intrathecal sufentanil and morphine produces analgesia of rapid onset and with a duration of 24 hours for post-operative analgesia. Cafiero T et al (2004)⁵ concluded that sufentanil provide more effective transition analgesia in comparison with tramadol for post-operative pain management. Fourniers R et al (2005)⁶ showed that after total hip replacement intrathecal route of sufentanil administration rapidly offers excellent analgesia of better quality and longer, duration when compared with intravenous route.

The results of present study revealed that intrathecal and epidural sufentanil have similar degree of onset of analgesia. In group-I 75% had onset of analgesia within 5 minutes, 20% had onset

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of analgesia between 5-15 minutes and 5% had onset of analgesia from 15-30 minutes. In Group-II 25% patients had onset of analgesia within 5 min and 75% have onset of analgesia between 5-15 minutes. In Group-III 30% patients had onset of analgesia within 5 minutes, 50% had onset between 5-15 minutes and 20% patients had onset between 15-30 minutes. Mean onset of analgesia in group-I = 5.00 ± 5.12 minutes. Mean onset of analgesia in group-II = 8.12 ± 3.33 minutes. Mean onset of analgesia in group-III = 10.25 ± 7.11 minutes.

Hamber E A, Vicomt Cm (1999)⁷ concluded that neuraxial administration of lipophilic opioid such as fentanyl and sufentanil, tends to provide rapid onset of analgesia (5-15 min) and rapid clearance from CSF may limit cephalad spread and development of certain side effects such as delayed depression. Leu S S, Mac Donald S D (2001)⁸ concluded that single dose intrathecal administration of lipophilic opioid provide rapid onset (minutes) combined with moderate duration of action (4 hrs) and minimal risk of respiratory depression. Samuel C. Hughes, Mark A. Rosen et al. (2002)⁹ concluded that sufentanil when given epidurally has brief duration of action (2-5 hrs) and onset in 15 minutes.

Regarding analgesia this study revealed that $10\mu\text{gm}$ sufentanil epidurally has maximum duration of analgesia than intrathecal than intravenous. 50% patient in group I had 30 minutes duration of analgesia while 40% patient had 90 minutes duration of analgesia while 5% patient had 150 minutes and 5% patient had 210 minutes duration of analgesia. In Group-II patients 10% patients had 30 minutes duration of analgesia, 30% patients had 90 minutes, 30% patients had 150 minutes, 25% patients had 210 minutes and 5% patients had 270 minutes duration of analgesia. In Group III 5% patients had 30 minutes duration of analgesia, 5% patients had 90 minutes, 10% patients had 150 minutes 50% patients had 150 minutes, and 30% patients had 270 minutes while 10% patients had 330 minutes duration of analgesia. Mean duration of analgesia is Group-I = 66.00 ± 48.86 minutes. Mean duration of analgesia is Group-II = 141.00 ± 65.36 minute. Mean duration of analgesia is Group-III = 219.00 ± 73.54 minutes.

Leu S S, Mac Donald S D (2001)⁸ concluded that single dose intrathecal administration of lipophilic opioid provide rapid onset (minutes) combined with moderate duration of action (<4hrs) and minimal risk of respiratory depression.

Post-operative pain is a dynamic event and is affected by many factors e.g., Type of surgery, psychological status of patient, sex etc. The use of visual analogue scale is hereby effective for comparisons with one group of patients. Mean VAS in group-I at 15 minutes after giving drug is 0.4 ± 0.59 , 2 hrs after giving drug is 1.60 ± 0.99 and 6 hrs after giving drug is 3.35 ± 0.93 . Mean VAS in group-II 15 minutes after giving drug is 0.40 ± 0.59 , 2 hrs after giving drug is 0.75 ± 0.63 and 6 hrs after giving drug is 3.90 ± 0.85 . Means VAS is group-III 15 minutes after giving drug is 0.70 ± 0.57 , 2 hrs after giving drug is 0.90 ± 0.64 and 6 hrs. After giving drug is 1.84 ± 0.74 .

There was no clinical and statistical significance is mean VAS between group-I and II after 15 minutes while there was significant difference between two groups at 2 hrs and no difference at 6 hrs after giving drug. There was no clinical and statistical significance is mean VAS after 15 minutes between Group-I and III, difference after 2 hr. and highly significant after 6 hrs of drug administration. There was no clinical and statistical significant difference at 15 minutes and 2 hrs after drug administration between group II and III while there was difference at 6 hrs after drug administration.

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This shows that quality of analgesia was better in intravenous & intrathecal 10µgm sufentanil after 15 minutes of drug administration while quality was better with intrathecal and epidural 10µgm sufentanil after 2 hrs. While quality was best after epidural 10µgm sufentanil at 6 hrs after drug administration. Lin CS, Lu CR, Ruan LY, Gu MN 2006 Feb,¹⁰ concluded that patient controlled intravenous sufentanil provide better efficacy of analgesia and sedation with lower incidence of nausea and vomiting than fentanyl in postoperative patients with thoracotomy.

There was no significant difference for SBP, DBP and pulse rate between the groups at 15 minutes, 2 hrs and 6 hrs after drug administration. So we conclude that patients remained vitality stable after giving sufentanil through any route. Mathew HM, Furness G., Carson I.W., et al. (1988)¹¹ concluded that little or no depression of cardiac index or pump function has been reported after sufentanil in humans.

Rescue analgesic requirement was maximum with intravenous 10µgm sufentanil 40% patients required rescue analgesic 20 minutes after giving drug, while 60% required 2 hrs after giving drug. In group II there was least rescue analgesic requirement 20% required rescue analgesic after 2 hrs while 90% patients required after 6 hrs. In Group III rescue analgesic requirement was 20% after 20 minutes, 50% after 2 hrs and 30% after 6 hrs.

CONCLUSION: The result of this study suggests that 10µgm epidural sufentanil has longer duration of action than intrathecal and intravenous 10µgm sufentanil with fewer side effects.

Quality of pain relief was denser with intravenous and intrathecal 10µgm sufentanil as compared to epidural sufentanil and rescue analgesic requirement was least with intrathecal route.

So we concluded that sufentanil 10µgm intrathecally provide rapid and effective analgesia for 3-4 hrs. Duration than intravenous and epidural route.

REFERENCES:

1. Fournier R, Weber A, Gamulin Z: Intrathecal sufentanil is more potent than intravenous for post-operative analgesia after total hip replacement *Reg. Anaesth. Pain Med.* 2005 May – Jun; 30 (2): 249-54.
2. Cleland, J. G. P.: Continuous pre-dural and caudal analgesia in surgery and early ambulation. *North. W. Med. Seattle*, 1949; 48, 26.
3. Dyer RA, Camden – Smith K, James MF: Epidural liodcaine with sufentanil and epinephrine for abdominal hysterectomy under GA: *Resp. Depression and Post-operative analgesia. Can. J. Anaesth.*, 1992 Mar; 39 (3): 220-5.
4. Mason N, Gondret R, Junca A, Bonnet F: Intrathecal Sufentanil and Morphine for post thoracotomy pain relief. *Br. J. Anaesth.* 2002 Jun; 88 (6): 880 -1; Author reply 881.
5. Cafiero T, Di Minno RM, Shivolella G, DI Torio C: Immediate Post-operative pain management in patients undergoing major abdominal surgeries after ramifentanil-based anaesthesia: Sufentanil Vs. Tramadol. *Minervba Anaesthesiol* 2004 Sep; 70 (9): 661-9.
6. Hamber EA, Viscomi CM: Intrathecal lipophilic opioid as adjuvant to surgical spinal anaesthesia, *Reg. Anesth. Pain Med.*, 24: 255, and 1999.
7. Leu S S, Mac Donald S D (2001)⁵³ concluded. Leu SS, Mac Donald SB: Current issues in spinal anesthesia *Anesthesiology* 94: 888, 2001.

ORIGINAL ARTICLE

8. Samuel C. Hghes, Mark A Rosen, Gershon Levinson, Sol M. Shnider: Shnider and Levinson's Anaesthesia for Obstetrics – 2002.
9. Lin CS, Lu CR, Ruan LY, Gu MN: Patient controlled intravenous analgesia with sufentanil and fentanyl after thoracotomy: a comparative study: Nan Fang Yi Ke Da Xue Xue Bao. 2006 Feb.; 26 (2): 240-1, 244.
10. Mathews HM, Furness G, Carson IW, et al: Comparison of sufentanil-oxygen and fentanyl-oxygen anaesthesia for coronary artery bypasses grafting. Br J Anaesth 60: 530-535, 1988.
11. Roxane Fournier M.D., Anne Weber M.D. and Zdravko Gamulin M. D., Intrathecal sufentanil is more potent than intravenous for postoperative analgesia after total hip replacement: May, 2005.

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